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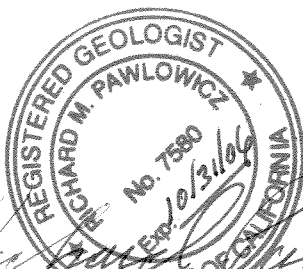
**COMPREHENSIVE LONG-TERM ENVIRONMENTAL
ACTION NAVY
CLEAN 3**

**FINAL
REMEDIAL INVESTIGATION REPORT FOR
OPERABLE UNIT 7 CAOCs 9.60, 10.27, 10.35,
10.37, 10.38/10.39, N-2 AREA 1, AND 10 AT
MARINE CORPS LOGISTICS BASE BARSTOW
BARSTOW, CALIFORNIA**

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Volume I of II

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EXECUTIVE SUMMARY

A remedial investigation (RI) was conducted for Operable Unit (OU) 7, which comprises Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Areas of Concern (CAOCs) 9.60, 10.27, 10.35, 10.37, 10.38/10.39, N-2 Area 1, and 10 at Marine Corps Logistics Base (MCLB) Barstow, California (Figures ES-1 and ES-2). Bechtel Environmental, Inc., prepared this RI Report on behalf of the Department of the Navy, Southwest Division Naval Facilities Engineering Command, in accordance with Contract Task Order 0026 issued under the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract No. N68711-95-D-7526. The RI was conducted in accordance with the Work Plan for OU 7 CAOCs (BEI 2003).

The information presented in this report will be used to support the required decision-making process and appropriate response actions for the OU 7 CAOCs. Because the RI objectives, scopes, and data quality objectives (DQOs) are unique for each of the OU 7 CAOCs, they are presented in separate attachments (each corresponding to a separate OU 7 CAOC) to this RI Report. The following is a summary of the OU 7 RI findings.

BASE BACKGROUND

MCLB Barstow is located in the central Mojave Desert in San Bernardino County, California, and consists of two main areas, Nebo Main Base (4,006 acres) and Yermo Annex (1,680 acres). The mission of MCLB Barstow is to provide quality logistical support to Fleet Marine Forces, Department of Defense agencies, and other military organizations by receiving, maintaining, repairing, and storing military supplies and equipment. MCLB Barstow also trains new Marines in the logistical skills of warehousing.

PREVIOUS INVESTIGATIONS

The Navy conducted a series of studies at MCLB Barstow as part of the Navy Assessment and Control of Installation Pollutants Program to determine the presence of contamination in soil and groundwater. An initial assessment study (IAS) was conducted to evaluate past practices of hazardous waste handling, storage, and disposal and to identify areas representing a potential threat to human health and the environment. The IAS identified 33 potential sites of contamination through record searches, employee interviews, and site surveys. These sites are referred to as CAOCs and are currently being addressed under the base CERCLA program (BNI 1998).

On 15 November 1989, United States Environmental Protection Agency (U.S. EPA) placed MCLB Barstow on the National Priorities List. This decision was based on the U.S. EPA hazard ranking system score and the fact that groundwater (drinking water wells were found to have trichloroethene [TCE] during sampling in 1988 [IT 1988]) is the sole source of drinking water for the city of Barstow and surrounding areas.

A Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) was begun in 1991 to comply with the schedule set forth in the 1990 Federal Facilities Agreement. The RFA process at MCLB Barstow included a preliminary review, visual

site inspection, and sampling visit to identify releases or potential releases that may require further action or investigation (BNI 1998).

As a result of the findings of the RFA, an extended RCRA facility assessment (ERFA) was conducted from 2000 to 2001. The results of the ERFA, as well as other OU 7 CAOC-relevant investigations, are discussed in Attachments A through G.

An ecological risk assessment (ERA) was performed as part of two MCLB Barstow RIs for OUs 3, 4, 5, and 6 (U.S. EPA 1996). The CAOCs identified in these two RIs either overlap or are near the CAOCs in the OU 7 RI. The ERA recommended no additional ecological evaluation at MCLB Barstow until industrial uses of the base are discontinued. However, as indicated in a subsequent letter from the California Environmental Protection Agency Department of Toxic Substances Control, the ERA was conditionally accepted by the regulatory agencies and approval was "limited only to the currently known situation at MCLBB CERCLA Sites" (DTSC 1996). The letter further stated, "At a later date, additional information may be needed, or the errors and ambiguities may need to be improved, if new and/or expanded work is proposed for the CERCLA sites at MCLBB."

Several OU 7 CAOCs were identified and sampled after the ERA and were not included in the ERA. Therefore, it is recommended that the data from and chemicals identified at the OU 7 CAOCs be used to conduct a new ERA that includes all the OU 7 CAOCs.

ENVIRONMENTAL SETTING

At Nebo Main Base, depth to groundwater during 2002 ranged from 10 feet to 210 feet below ground surface (bgs) (FWEC 2003). East of the Camp Rock-Harper Lake Fault zone strand, the groundwater flow was generally to the southeast, with a fairly consistent hydraulic gradient averaging 0.0031 foot per foot (FWEC 2003). West of this fault zone strand, groundwater flow was generally east-northeast with a hydraulic gradient ranging from 0.002 foot per foot (north part of Nebo) to 0.021 foot per foot (south part of Nebo) (FWEC 2003).

At Yermo Annex, water-level measurements collected during 2002 indicate that the depth to groundwater ranged from about 153 to 174 feet bgs (FWEC 2003). The general groundwater flow direction in the northern portion of Yermo Annex was from west to east and in the southern portion was from west/southwest to east/northeast (FWEC 2003).

NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination are summarized as follows for each CAOC.

CAOC 9.60, Former UST T-530B (Attachment A)

Results of soil gas, soil, and groundwater sampling indicated the following.

- The only site-related contaminants reported in soil above regulatory criteria are total petroleum hydrocarbons (TPH) and tetrachloroethene (PCE).

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- Reported concentrations above regulatory criteria are limited in extent to the east end of the former underground storage tank (UST) excavation area. TPH concentrations in a nearby boring were below leaking underground fuel tank (LUFT) criteria, indicating a limited lateral extent of TPH-impacted soil.
- TPH concentrations in soil decrease vertically to below laboratory detection limits or are below LUFT criteria.
- PCE (as well as other volatile organic compounds [VOCs]) concentrations in soil gas decrease overall with depth.
- n-Nitroso-di-n-propylamine reported during the RFA was a laboratory artifact and unrelated to base activities.
- Reported concentrations of contaminants in groundwater were below established regulatory criteria, with the exception of chloroform and PCE. Only chloroform was reported at a low concentration in the sample from the groundwater monitoring well downgradient of the former UST location.

CAOC 10.27, Old Fire-Fighting Training Facility (Attachment B)

Results of soil and groundwater sampling indicated the following.

- Five polynuclear aromatic hydrocarbons (PAHs) and two metals (arsenic and lead) were reported at concentrations exceeding residential preliminary remediation goals (PRGs). The lateral extent of PAHs in soil at concentrations exceeding PRGs is limited to the area around the drainage pipe in the railroad right-of-way.
- PAHs were not reported at concentrations above PRGs in any soil samples collected below 3.5 feet bgs.
- All reported arsenic concentrations exceeded PRGs; however, arsenic exceeded background concentrations in only four soil samples. Arsenic is a common, naturally occurring metal in the region. The lateral and vertical extent of arsenic appears to be delineated.
- Lead was reported at concentrations exceeding residential PRGs in only two soil samples at 0.5 foot bgs and 3.5 feet bgs. Subsequent soil sample results from adjacent borings did not indicate the presence of lead exceeding residential PRGs. Lead was not reported at concentrations exceeding PRGs or background at depths greater than 10 feet bgs.
- RI groundwater results indicated that two semivolatile organic compounds (SVOCs) (both phthalates) are present at concentrations below tap water PRGs and that lead is not present in groundwater at concentrations exceeding the laboratory detection limit.

CAOC 10.35, Old Domestic Wastewater Treatment Plant (Attachment C)

Results of soil and groundwater sampling indicated the following.

- Soil PRGs were exceeded for only Aroclor 1260, dieldrin (reported in one sample above its residential PRG), and arsenic. Soil sampling was sufficient to delineate these exceedances.
- Low concentrations of VOCs (less than 1 microgram per liter [$\mu\text{g/L}$]) in groundwater (well MW-F) crossgradient of the CAOC are attributed to the North VOC Groundwater Plume.
- The pesticide 4,4'-dichlorodiphenyltrichloroethane (DDT) was reported in groundwater but not in soil; therefore, CAOC 10.35 is not believed to be the source of this 4,4'-DDT.

CAOC 10.37, Industrial Wastewater Treatment Plant (Attachment D)

Results of soil gas, soil, and groundwater sampling indicated the following.

- Acetone, PCE, TCE, and chloroform were reported in soil gas in the northern area of Evaporation Basin 2 at concentrations from 0.02 to 139 $\mu\text{g/L}$ at depths to 20 feet bgs. Fuel-related VOCs (toluene and xylenes) were reported in soil gas at five locations across the CAOC at concentrations from 0.54 to 1.7 $\mu\text{g/L}$ at depths to 20 feet bgs.
- Chloroform was also reported in soil gas samples from several borings north of Evaporation Basin 5 and from two borings along the southern CAOC boundary. Chloroform is likely a by-product of the reaction between chloride (used during previous industrial waste treatment plant treatment activities) and organic material.
- TPH as diesel and TPH as motor oil were reported in the shallow soil (0 foot to 10 feet bgs) or at concentrations decreasing with depth, with the exception of a reported diesel concentration from boring B-8. This boring was located in the western portion of the CAOC, downgradient of former UST T-325 (recommended for site closure in August 2003). Shallow soil TPH impacts are from former CAOC-related activities. The vertical and lateral extent of TPH in soil has been defined.
- PAHs were reported in soil at concentrations exceeding PRGs at a maximum depth of 5 feet bgs. In all but one boring (N10.37-8), the vertical extent of PAHs has been defined by deeper samples. These PRG exceedances were reported in soil samples from the western portion of the CAOC (boring N10.37-1) located near the wet well, in the western sludge-drying bed, north of Evaporation Basins 4 and 5, and southeast of Evaporation Basin 5. PAHs at concentrations exceeding PRGs in the area north of Evaporation 5 and in the western sludge-drying bed are defined laterally and vertically. However, the extent of PAHs has not been defined in the following three areas:
 - north and northwest of Evaporation Basin 4

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- southeast to southwest of boring N10.37-1
- south and east of Evaporation Basin 5

Sources for PAHs at the CAOC include the sludge-drying beds, evaporation basins, wet well, and water overspray blown from the evaporation basins by aeration sprinklers on windy days. A non-CAOC-related source is the presence of clay target fragments from the adjacent former skeet and trap range underlying the eastern portion of CAOC 10.37.

- Groundwater sampling results from the UST site assessment (groundwater sampling was not conducted during the RI) indicated the presence of TPH and fuel-related constituents, most likely from former UST T-325. More recent groundwater monitoring activities in 1999 indicated the presence of chloroform, toluene, and five metals at concentrations below maximum contaminant levels (MCLs). Monitoring after 1999 did not indicate the presence of benzene, toluene, ethylbenzene, xylenes, SVOCs, or fuels in groundwater, and the former UST has been recommended for site closure (Brown and Caldwell 2003).

CAOC 10.38/10.39, Domestic and Industrial Wastewater Collection Lines (Attachment E)

To use all the data collected most efficiently, the domestic wastewater collection and industrial wastewater collection line segments that make up CAOC 10.38/10.39 were grouped into seven units. Results of soil gas, soil, and groundwater sampling and a summary of the nature and extent of contamination for each unit are as follows.

- Unit 1 (DS1 and IS1) – The results of soil gas, soil, and groundwater sampling near these collection lines do not suggest that a contaminant release from DS1 or IS1 has occurred. VOCs reported in groundwater are likely related to the North VOC Groundwater Plume.
- Unit 2 (DS3 and IS2) – Soil gas and soil sampling were conducted adjacent to offset pipe joints and break zones located downgradient of facilities suspected to have discharged industrial wastes into these collection lines. Sampling results do not suggest that a contaminant release from DS3 or IS2 has occurred.
- Unit 3 (DS9) – Soil gas and soil sampling were conducted adjacent to several facilities suspected to have discharged industrial wastes into DS9 as well as adjacent to a severe offset pipe joint located downgradient of these facilities. Sampling results do not suggest that a contaminant release from DS9 has occurred.
- Unit 4 (DS11 and IS4) – Soil gas and soil sampling results do not suggest a contaminant release from DS11 or IS4 has occurred in the areas sampled. Sampling results at 10.38-DS14-2 and 10.38-DS14-2A also indicate that collection line breaks are not the source of the VOCs at Building 322.
- Unit 5 (DS12) – Soil sampling results do not suggest a contaminant release from DS12 has occurred.
- Unit 6 (DS14) – Soil gas, soil, and groundwater sampling results do not suggest a contaminant release from DS14 has occurred. In addition, these results

suggest that the documented breaks in collection line DS14 are not the source of VOCs reported at boring 10.38V16.

- Unit 7 (DS17) – DS17 consists of drainage ditches (not buried discharge lines). Soil gas, soil, and groundwater sampling were conducted at Unit 7. Sampling results indicate that low concentrations of VOCs (TCE was reported at concentrations exceeding maximum contaminant levels and naphthalene was reported at a concentration exceeding its Cal-Modified tap water PRG) are present in groundwater and distributed sporadically in the general area extending from DS17-2 northeastward to DS17-3. The source of VOCs in groundwater in the area is not discernible.

CAOC N-2 Area 1, Former Storage Area (Attachment F)

Based on soil sampling results from the RI and previous investigations, the extent of PAHs in shallow soil appears to be directly related to the presence of clay target fragments resulting from activities at the former skeet and trap range, which is not a part of CAOC N-2 Area 1. Furthermore, SVOCs (PAHs) were not reported in soil samples collected below 0.5 foot bgs, and the extent of the polychlorinated biphenyl (PCB) Aroclor 1254 (reported at a concentration exceeding the residential PRG) appears limited to the southern central portion of the CAOC near boring AOCN2-A1-2. The potential presence of contaminants related to the former storage area has not been assessed in the portion of CAOC N-2 Area 1 located east of the CAOC 7 landfill cap.

CAOC 10, Sodium Valve Burial Area (Attachment G)

The results of the soil and soil gas sampling of soil borings and trenches at CAOC 10 indicate that reported concentrations of VOCs, SVOCs, herbicides, PCBs, and pesticides were below PRGs. All dioxins/dibenzofurans were reported at concentrations exceeding residential PRGs at least once, and six target analyte list (TAL) metals were reported above background and/or residential PRGs. Soil sampling was sufficient to vertically and laterally delineate these TAL metal exceedances.

POTENTIAL FATE AND TRANSPORT MECHANISMS

The prevailing climatic conditions in the local area provide several viable transport mechanisms for possible migration of contaminants at the OU 7 CAOCs. These are atmospheric transport of vapors and fugitive dust, surface water runoff and transport of contaminated soils and sediment, and at CAOC 9.60 and 10.38/39 Unit 7, transport of VOCs to groundwater and subsequent lateral movement in the direction of groundwater flow. These transport mechanisms are somewhat mitigated by the relatively low concentrations of contaminants in soil, depth at which they are present (generally not present in surficial soil), low average annual rainfall coupled with high evapotranspiration rates, and presence of surface cover over several of the CAOCs. Transport of VOCs to groundwater and subsequent lateral movement in the direction of groundwater flow are viable transport mechanisms at CAOCs 9.60 and 10.38/10.39 (Unit 7).

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HUMAN-HEALTH RISK ASSESSMENT

A baseline human-health risk assessment (HHRA) was performed to assess potential human-health impacts from contaminants at the seven CAOCs if no remedial actions were taken. The baseline HHRA documents the hazards and provides information necessary to make risk management decisions on the necessity for remedial actions. The HHRA evaluated three scenarios for each of the CAOCs:

- residential scenario – children and adult residents exposed to shallow soil (0 foot to 13 feet bgs) soil gas, and groundwater
- industrial worker scenario – industrial workers exposed to surface soil (0 foot to 2 feet bgs), soil gas, and groundwater
- maintenance/repair worker scenario – maintenance/repair workers exposed to shallow soil (0 foot to 13 feet bgs), soil gas, and groundwater

Results of the HHRA showed that cancer risks at CAOCs 9.60, 10.37, 10.38/10.39 (Units 2, 3, 4, and 6), and 10 were below or within the National Oil and Hazardous Substances Pollution Contingency Plan's (NCP's) generally acceptable risk management range of 10^{-6} to 10^{-4} . Cancer risk at CAOC 10.27 was mostly due to the presence of arsenic, benzo(a)pyrene, and pentachlorodibenzofuran in soil; cancer risk at CAOC 10.35 was mostly due to arsenic, PCE, Aroclor 1260, and DDT; and cancer risk at CAOC N-2 Area 1 was due to the presence of several PAHs in soil. Cancer risk drivers representing at least 10 percent of the risk at the CAOCs included VOCs (mostly chloroform, PCE, and TCE), SVOCs (primarily PAHs), a pesticide (DDT), and a metal (arsenic). Tables ES-1 and ES-2 summarize the cancer risks and risk drivers at the seven CAOCs.

CONCLUSIONS AND RECOMMENDATIONS

The data collected during the RI and previous investigations were sufficient to characterize the nature and extent of contamination, to perform HHRAs, and to support decisions on the necessity for future work at the OU 7 CAOCs. The following are recommended for each of the CAOCs.

CAOC 9.60, Former UST T-530B

- no further action for soil
- groundwater monitoring of well 9.60-MW-1 for VOCs (including chloroform) under the OU 1 Groundwater Monitoring Program (additional wells may be installed/monitored to further assess the groundwater gradient)

CAOC 10.27, Old Fire-Fighting Training Facility

- no further action

CAOC 10.35, Old Domestic Wastewater Treatment Plant

- no further action for soil

- groundwater monitoring of existing or future monitoring wells (in the vicinity of CAOC 10.35) for 4,4'-DDT under the OU 2 Groundwater Monitoring Program

CAOC 10.37, Industrial Wastewater Treatment Plant

- further investigation to define the extent of PAHs and chloroform in soil in the following areas:
 - north and northwest of Evaporation Basin 4
 - southeast to southwest of boring N10.37-1
 - south and east of Evaporation Basin 5
- groundwater monitoring of wells NSI-3, T-325-MW3, and NE-23 for VOCs (including chloroform) under the OU 2 Groundwater Monitoring Program

CAOC 10.38/10.39, Domestic and Industrial Wastewater Collection Lines

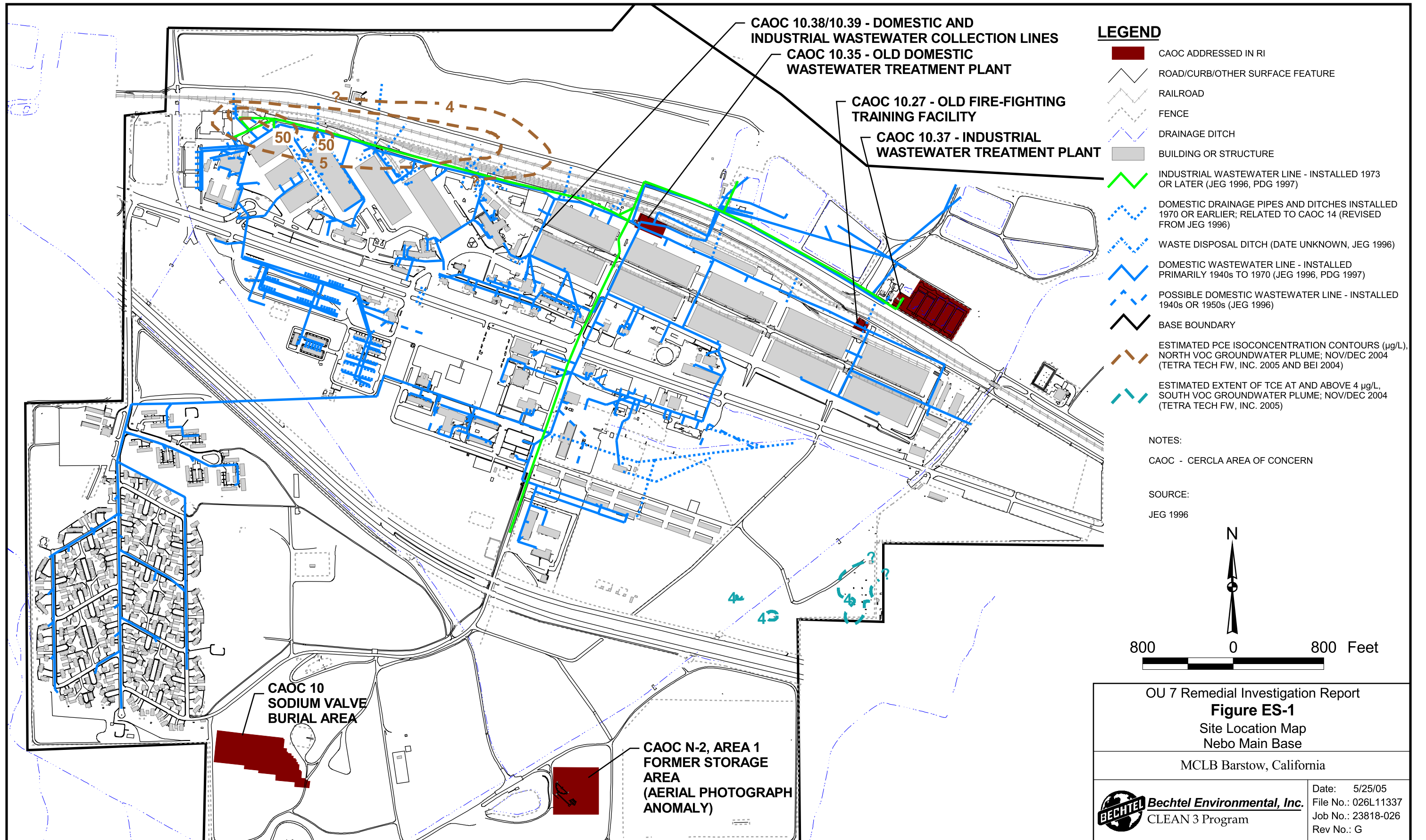
- no further action for Units 1 through 6, and for soil at Unit 7
- further investigation of groundwater at Unit 7

CAOC N-2 Area 1, Former Storage Area (Because of a change in the investigative approach to the CAOC, the following recommendations incorporate the former skeet and trap range area, which is the primary source of PAHs in soil.)

- further assessment of PAHs west of borings N2-RI-1 and N2-RI-2, and north and west of boring N2-RI-3
- further assessment for the portion of the CAOC east of the CAOC 7 landfill cap to assess the potential presence of SVOCs, PCBs, and metals
- investigation and delineation of the lead shot associated with the former skeet and trap range
- name change for the CAOC to the Former Storage Area and Skeet and Trap Range

CAOC 10, Sodium Valve Burial Area

- advance three borings around RI sample location 10-Trench-B1 and collect soil samples for lead analysis to support a no further action recommendation



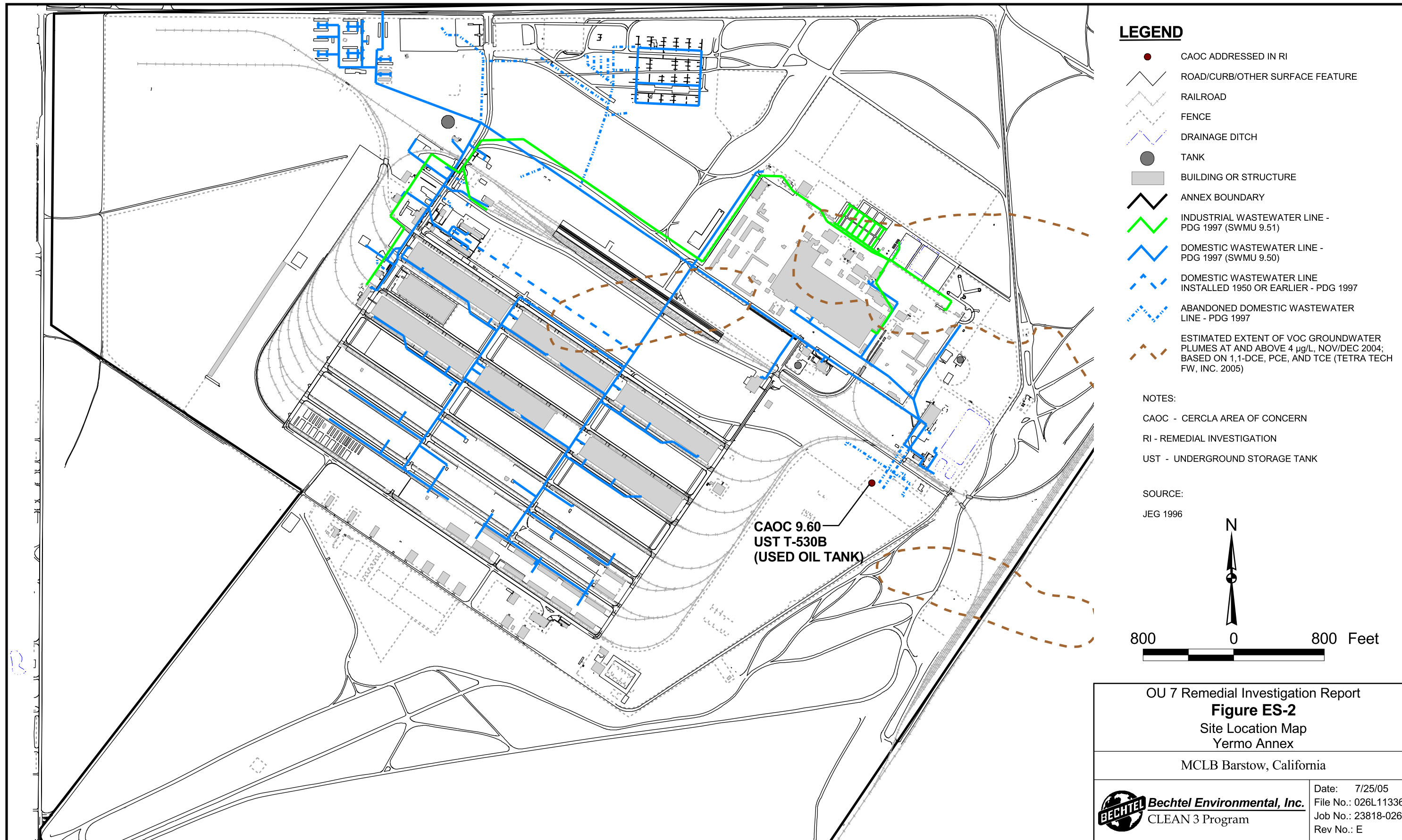


Table ES-1
Summary of Cancer Risks and Hazard Indices
at OU 7 CAOCs

Receptor	CAOC 9.60	CAOC 10.27	CAOC 10.35	CAOC 10.37	CAOC 10.38/10.39						CAOC N-2 Area 1	CAOC 10
					Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 7		
Resident												
U.S. EPA Cancer Risk												
Total	2.9×10^{-5}	5.1×10^{-5}	2.5×10^{-5}	3.8×10^{-5}	3.7×10^{-5}	1.0×10^{-8}	1.5×10^{-5}	1.2×10^{-8}	1.7×10^{-5}	2.7×10^{-4}	8.0×10^{-4}	1.2×10^{-5}
Incremental	2.9×10^{-5}	4.1×10^{-5}	1.6×10^{-5}	3.8×10^{-5}	2.7×10^{-5}	1.0×10^{-8}	5.5×10^{-6}	1.2×10^{-8}	7.5×10^{-6}	2.7×10^{-4}	7.9×10^{-4}	2.5×10^{-6}
Cal/EPA Cancer Risk												
Total	2.5×10^{-5}	2.3×10^{-4}	1×10^{-4}	4.8×10^{-5}	2.3×10^{-4}	1.3×10^{-8}	9.1×10^{-5}	1.0×10^{-8}	1.0×10^{-4}	2.5×10^{-5}	1.3×10^{-3}	7.4×10^{-5}
Incremental	2.5×10^{-5}	1.7×10^{-4}	4.1×10^{-5}	4.8×10^{-5}	1.7×10^{-4}	1.3×10^{-8}	3.2×10^{-5}	1.0×10^{-8}	4.1×10^{-5}	2.5×10^{-5}	1.2×10^{-3}	1.5×10^{-5}
Hazard Index	0.74	2.9	0.77	0.55	1.6	0.76	0.71	0.02	0.85	2.4	0.92	0.23
Industrial Worker												
U.S. EPA Cancer Risk												
Total	9.8×10^{-7}	8.6×10^{-6}	6.4×10^{-6}	1.3×10^{-5}	1.0×10^{-5}	5.0×10^{-9}	4.5×10^{-6}	2.6×10^{-9}	8.2×10^{-8}	2.3×10^{-7}	1.8×10^{-3}	4.0×10^{-6}
Incremental	9.8×10^{-7}	8.6×10^{-6}	3.7×10^{-6}	1.0×10^{-5}	7.3×10^{-6}	5.0×10^{-9}	1.8×10^{-6}	2.6×10^{-9}	8.2×10^{-8}	2.3×10^{-7}	1.8×10^{-3}	1.3×10^{-6}
Cal/EPA Cancer Risk												
Total	9.7×10^{-7}	1.1×10^{-5}	3.0×10^{-5}	4.2×10^{-5}	6.3×10^{-5}	5.4×10^{-9}	2.8×10^{-5}	2.9×10^{-9}	6.0×10^{-8}	2.3×10^{-7}	2.6×10^{-3}	2.4×10^{-5}
Incremental	9.7×10^{-7}	1.1×10^{-5}	1.3×10^{-5}	2.5×10^{-5}	4.6×10^{-5}	5.4×10^{-9}	1.1×10^{-5}	2.9×10^{-9}	6.0×10^{-8}	2.3×10^{-7}	2.6×10^{-3}	7.0×10^{-6}
Hazard Index	0.02	0.0074	0.14	0.072	0.21	0.04	0.063	0.0013	0.079	0.011	0.14	0.024
Maintenance/Repair Worker												
U.S. EPA Cancer Risk												
Total	4.4×10^{-7}	2.6×10^{-6}	9.1×10^{-7}	2.1×10^{-6}	1.8×10^{-6}	6.7×10^{-10}	7.5×10^{-7}	7.5×10^{-10}	8.4×10^{-7}	1.2×10^{-8}	5.6×10^{-5}	6.1×10^{-7}
Incremental	4.4×10^{-7}	2.1×10^{-6}	4.4×10^{-7}	2.1×10^{-6}	1.3×10^{-6}	6.7×10^{-10}	2.8×10^{-7}	7.5×10^{-10}	3.7×10^{-7}	1.2×10^{-8}	5.6×10^{-5}	1.4×10^{-7}
Cal/EPA Cancer Risk												
Total	4.4×10^{-7}	1.2×10^{-5}	4.8×10^{-6}	3.2×10^{-6}	1.2×10^{-5}	8.8×10^{-10}	4.6×10^{-6}	5.9×10^{-10}	5.2×10^{-6}	1.3×10^{-8}	8.9×10^{-5}	3.7×10^{-6}
Incremental	4.4×10^{-7}	9.1×10^{-6}	1.9×10^{-6}	3.2×10^{-6}	9.1×10^{-6}	8.8×10^{-10}	1.7×10^{-6}	5.9×10^{-10}	2.3×10^{-6}	1.2×10^{-8}	8.6×10^{-5}	8.0×10^{-7}
Hazard Index	0.011	1.1	0.35	0.056	0.61	0.28	0.3	0.0067	0.34	0.028	0.33	0.097

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
OU – operable unit
U.S. EPA – United States Environmental Protection Agency

Table ES-2
Summary of Cancer Risk Drivers at OU 7 CAOCs*

Receptor	CAOC 9.60	CAOC 10.27	CAOC 10.35	CAOC 10.37	CAOC 10.38/10.39							CAOC N-2 Area 1	CAOC 10
					Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 7			
Resident													
U.S. EPA Cancer Risk													
Total	Chloroform (21%) – groundwater vapor inhalation	Arsenic (69%) – incidental soil ingestion	Arsenic (60%) – incidental soil ingestion	Benzo(a)pyrene (45%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	TCE (96%) – groundwater vapor inhalation	Benzo(a)pyrene (65%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
	PCE (32%) – inhalation of indoor air	Benzo(a)pyrene (13%) – incidental soil ingestion	PCE (20%) – ingestion of drinking water	Chloroform (14%) – indoor air inhalation							Dibenz(a,h)anthracene (18%) – incidental soil ingestion		
	PCE (23%) – incidental soil ingestion		DDT (11%) – ingestion of dinking water, dermal contact with groundwater										
	PCE (22%) – ingestion of groundwater												
Incremental	NA	Arsenic (61%) – incidental soil ingestion	Arsenic (35%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	TCE (96%) – groundwater vapor inhalation	Benzo(a)pyrene (66%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
			PCE (32%) – ingestion of drinking water										
		Benzo(a)pyrene (15%) – incidental soil ingestion	DDT (17%) – ingestion of dinking water, dermal contact with groundwater								Dibenz(a,h)anthracene (18%) – incidental soil ingestion		
			Aroclor 1260 (12%) – incidental soil ingestion										
Cal/EPA Cancer Risk													
Total	PCE (37%) – Inhalation of indoor air	Arsenic (91%) – incidental soil ingestion	Arsenic (91%) – incidental soil ingestion	Benzo(a)pyrene (58%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	PCE (29%) – ingestion of groundwater	Benzo(a)pyrene (66%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
	PCE (27%) – incidental soil ingestion									TCE (22%) – groundwater vapor inhalation			
	PCE (26%) – ingestion of groundwater									Bromodichloromethane (15%) – groundwater vapor inhalation			
Incremental	NA	Arsenic (88%) – incidental soil ingestion	Arsenic (78%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	PCE (29%) – ingestion of groundwater	Benzo(a)pyrene (69%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
			PCE (12%) – ingestion of drinking water							TCE (22%) – groundwater vapor inhalation			
										Bromodichloromethane (15%) – groundwater vapor inhalation			

Table ES-2
Summary of Cancer Risk Drivers at OU 7 CAOCs*

Receptor	CAOC 9.60	CAOC 10.27	CAOC 10.35	CAOC 10.37	CAOC 10.38/10.39						CAOC N-2 Area 1	CAOC 10	
					Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 7			
Industrial Worker													
U.S. EPA Cancer Risk													
Total	NA	Benzo(a)pyrene (42%) – incidental soil ingestion	Arsenic (69%) – incidental soil ingestion	Arsenic (39%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (98%) – incidental soil ingestion	NA	NA	NA	Benzo(a)pyrene (67%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
		Pentachlorodibenzofuran (12%) – incidental soil ingestion	Aroclor 1260 (23%) – incidental soil ingestion	Benzo(a)pyrene (22%) – incidental dermal contact							Dibenz(a,h)anthracene (20%) – incidental soil ingestion		
				PCE (18%) – incidental soil ingestion									
Incremental	NA	NA	Arsenic (46%) – incidental soil ingestion	Arsenic (23%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (94%) – incidental soil ingestion	NA	NA	NA	Benzo(a)pyrene (67%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
			Aroclor 1260 (41%) – incidental soil ingestion	Benzo(a)pyrene (27%) – incidental dermal contact							Dibenz(a,h)anthracene (20%) – incidental soil ingestion		
				PCE (23%) – incidental dermal contact									
				Dibenz(a,h)anthracene (11%) – incidental dermal contact									
Cal/EPA Cancer Risk													
Total	NA	Benzo(a)pyrene (55%) – incidental dermal contact	Arsenic (93%) – incidental soil ingestion	Arsenic (76%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	NA	NA	Benzo(a)pyrene (66%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
				Benzo(a)pyrene (11%) – incidental soil ingestion									
Incremental	NA	NA	Arsenic (85%) – incidental soil ingestion	Arsenic (60%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	NA	NA	Benzo(a)pyrene (69%) – incidental soil ingestion	Arsenic (100%) – incidental soil ingestion	
			Aroclor 1260 (12%) – incidental soil ingestion	Benzo(a)pyrene (18%) – incidental soil ingestion									
				PCE (12%) – incidental dermal contact									

Table ES-2
Summary of Cancer Risk Drivers at OU 7 CAOCs*

Receptor	CAOC 9.60	CAOC 10.27	CAOC 10.35	CAOC 10.37	CAOC 10.38/10.39						CAOC N-2 Area 1	CAOC 10	
					Unit 1	Unit 2	Unit 3	Unit 4	Unit 6	Unit 7			
Maintenance/Repair Worker													
U.S. EPA Cancer Risk													
Total	NA	Arsenic (65%) – incidental soil ingestion	NA	Benzo(a)pyrene (57%) – incidental dermal contact	Arsenic (100%) – incidental soil ingestion	NA	NA	NA	NA	NA	Benzo(a)pyrene (66%) – incidental soil ingestion	NA	
											Dibenz(a,h)anthracene (18%) – incidental soil ingestion		
Incremental	NA	Arsenic (58%) – incidental soil ingestion	NA	Benzo(a)pyrene (57%) – incidental dermal contact	Arsenic (100%) – incidental soil ingestion	NA	NA	NA	NA	NA	Benzo(a)pyrene (66%) – incidental soil ingestion	NA	
											Dibenz(a,h)anthracene (18%) – incidental soil ingestion		
Cal/EPA Cancer Risk													
Total	NA	Arsenic (92%) – incidental soil ingestion	Arsenic (96%) – incidental soil ingestion	Benzo(a)pyrene (63%) – incidental dermal contact	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	NA	NA	Benzo(a)pyrene (67%) – incidental soil ingestion	NA	
Incremental	NA	Arsenic (89%) – incidental soil ingestion	Arsenic (89%) – incidental soil ingestion	Benzo(a)pyrene (63%) – incidental dermal contact	Arsenic (100%) – incidental soil ingestion	NA	Arsenic (100%) – incidental soil ingestion	NA	NA	NA	Benzo(a)pyrene (70%) – incidental soil ingestion	NA	

Note:
* only cancer risk drivers with 10% or more risk are shown in this table

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
DDT – dichlorodiphenyltrichloroethane
NA – not applicable
OU – operable unit
PCE – tetrachloroethene
TCE – trichloroethene
U.S. EPA – United States Environmental Protection Agency

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ACRONYMS/ABBREVIATIONS

ABS _{GI}	gastrointestinal absorption
AOC	area of concern
APPL	Agriculture and Priority Pollutant Laboratory
AS	air sparging
ASTM	American Society for Testing and Materials
BEI	Bechtel Environmental, Inc.
bgs	below ground surface
BNI	Bechtel National, Inc.
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees Celsius
Cal/EPA	California Environmental Protection Agency
CAOC	CERCLA area of concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	(U.S. EPA) Contract Laboratory Program
COC	chain of custody
COPC	chemical of potential concern
CSF	cancer slope factor
CTO	contract task order
DDT	dichlorodiphenyltrichloroethane
DMP	data management plan
DoD	Department of Defense
DON	Department of the Navy
DQO	data quality objective
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
DWC	domestic wastewater collection
DWR	Department of Water Resources
EC	electrical conductivity
EPC	exposure point concentration
ERA	ecological risk assessment
ERFA	extended RCRA facility assessment
°F	degrees Fahrenheit
FCN	field change notice
FFA	Federal Facilities Agreement
f _{oc}	fraction organic carbon

FS	feasibility study
FWEC	Foster Wheeler Environmental Corporation
GETS	groundwater extraction and treatment system
GTGS	Groundwater Technology Government Services
HEAST	Health Effects Assessment Summary Tables
HHRA	human-health risk assessment
HI	hazard index
HRS	Hazard Ranking System
HSA	hollow-stem auger
IAS	initial assessment study
IDW	investigation-derived waste
IR	Installation Restoration
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IWC	industrial wastewater collection
IWTP	industrial waste treatment plant
JEG	Jacobs Engineering Group Inc.
K _d	distribution coefficient
K _{oc}	organic carbon partition coefficient
LUFT	leaking underground fuel tank
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MCL	maximum contaminant level
MCLB	Marine Corps Logistics Base
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
MSL	mean sea level
MTBE	methyl tert-butyl ether
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
OEHHA	Office of Environmental Health Hazard Assessment
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability

Acronyms/Abbreviations

PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
PR	preliminary review
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
RWQCB	(California) Regional Water Quality Control Board
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SOP	standard operating procedure
SOTA	SOTA Environmental Technology, Inc.
SSHP	site-specific safety and health plan supplement
SSHR	Site Safety and Health Representative
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
SWMU	Solid Waste Management Unit
TAL	target analyte list
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TWP	temporary wellpoint
UCL	upper confidence limit
UN	United Nations
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
VF _w	(upper-bound) volatilization constant
VOA	volatile organic analysis
VOC	volatile organic compound
VSI	visual site inspection

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Section 1

INTRODUCTION

This report summarizes the results of the remedial investigation (RI) conducted for Operable Unit (OU) 7, which comprises Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Areas of Concern (CAOCs) 9.60, 10.27, 10.35, 10.37, 10.38/10.39, N-2 Area 1, and 10 at Marine Corps Logistics Base (MCLB), Barstow, California (Figure 1-1). Bechtel Environmental, Inc., prepared this report on behalf of the Department of the Navy (DON), Southwest Division Naval Facilities Engineering Command (SWDIV), in accordance with Contract Task Order (CTO)-0026 issued under the Comprehensive Long-Term Environmental Action Navy (CLEAN) 3 Program, Contract No. N68711-95-D-7526. The RI was conducted in accordance with the Work Plan for OU 7 CAOCs (BEI 2003).

The United States Marine Corps, the lead agency for the RI/feasibility study (FS), worked in cooperation with the United States Environmental Protection Agency (U.S. EPA), California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), and Cal/EPA Regional Water Quality Control Board (RWQCB) Lahontan Region to implement the RI activities described in this report.

1.1 PROJECT PURPOSE AND SCOPE

The purpose of this RI Report is to present the methods, findings, and conclusions of the RI for OU 7 CAOCs (Figures 1-2 and 1-3). This report was prepared in accordance with the Navy Installation Restoration Program (IRP) (DON 1997) and the 24 October 1990 Federal Facilities Agreement (FFA) between the United States Marine Corps MCLB Barstow and U.S. EPA, DTSC, and RWQCB Lahontan Region (U.S. EPA, State of California, and the DON 1990).

The information presented in this report will be used to support the required decision-making process and appropriate response actions for the OU 7 CAOCs. The RI objectives, scopes, and data quality objectives (DQOs) for each of the OU 7 CAOCs are different; therefore, they are presented separately in attachments to this RI Report. Table 1-1 presents descriptions and characteristics of the CAOCs and lists the attachment for each CAOC.

1.1.1 Guidance and Agreements

Guidance to implement the RI was provided in the following documents:

- Navy/Marine Corps Installation Restoration (IR) Manual (DON 1997)
- Navy Environmental and Natural Resources Program Manual (DON 1994)
- Marine Corps Environmental Compliance Manual (DON 1990)
- Guide to Principal Threat and Low Level Threat Wastes (U.S. EPA 1991a)
- Presumptive Remedy for CERCLA Municipal Landfill Sites, EPA/540/F-93/035 (U.S. EPA 1993)
- U.S. EPA Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (U.S. EPA 1988)

The IR Manual specifies Navy and Marine Corps personnel responsibilities, describes the various steps of the IRP, and assures consistency with guidelines, regulations, and criteria associated with CERCLA/Superfund Amendments and Reauthorization Act of 1986 (SARA). The IR Manual provides several steps to evaluate the conditions of hazardous waste sites. The RI and this report also fulfill requirements of the October 1990 FFA.

The FFA is a cooperative agreement among the DON, U.S. EPA, DTSC, and RWQCB Lahontan Region. This agreement:

- assures that environmental impacts are investigated and appropriate response actions are taken to protect the public health and the environment;
- establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions;
- facilitates cooperation, exchange of information, and participation of the parties; and
- assures adequate assessment, prompt notification, cooperation, and coordination between federal and state agencies.

The draft final Work Plan (including responses to comments on the draft Work Plan), dated March 2003, became final at the end of the 30-day concurrence period on 10 April 2003, when no comments had been received (per Section 7.3[a][1] of the FFA signed 24 October 1990).

1.1.2 Remedial Investigation Approach

The Navy used the DQO process to prepare the Work Plan for the OU 7 RI/FS (BEI 2003). The DQO process involves seven planning steps designed to assure that the type, quantity, and quality of data to be collected and used in the decision-making process (Figure 1-4) are appropriate for the intended application. These steps are outlined in the Work Plan (BEI 2003).

To develop the set of DQO decisions for each of the OU 7 CAOCs, information from guidance documents and federal, state, and local regulations were considered. The primary references were:

- CERCLA/SARA guidelines for RI/FS (U.S. EPA 1988) and
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requirements (40 *Code of Federal Regulations* [CFR] 300.65).

The DQOs developed for each of the OU 7 CAOCs are presented in Attachments A through G of this report. These DQOs were used to identify data types and describe how these data support descriptions (i.e., conceptual site models) of physical characteristics of the CAOC, nature and extent of contamination, fate and transport of contaminants, and risk assessment. The DQOs also identified data uses to support development of potential remedial action objectives and potential response actions to be addressed in a subsequent FS.

Section 1 Introduction

1.1.3 Scope of Investigation

The RI for OU 7 CAOCs was implemented under CTO-0026. The methods used to carry out this investigation are presented in the Work Plan (BEI 2003). Table 1-1 indicates the scope of the RI for each CAOC and summarizes the suspected waste and contaminants at each CAOC.

1.2 SITE BACKGROUND

This section provides general information about MCLB Barstow and summarizes previous investigations related to the OU 7 CAOCs. Specific results and background from previous investigations as they relate to a CAOC are provided in each CAOC's respective attachment (A through G).

1.2.1 Location

MCLB Barstow is located in the central Mojave Desert in San Bernardino County, California (Figures 1-2 and 1-3). MCLB Barstow consists of two main areas, Nebo Main Base and Yermo Annex. Nebo Main Base (including the rifle range) is an area of approximately 4,006 acres, 3.5 miles east of the city of Barstow and is intersected by Interstate Highway 40 (Figure 1-2). Yermo Annex, with approximately 1,680 acres, is located 3 miles northeast of Nebo Main Base adjacent to Interstate Highway 15 (BNI 1998a) (Figure 1-3).

1.2.2 Base History

MCLB Barstow was established at Nebo Main Base in 1942 as a Marine Corps Depot of Supplies and served as a staging area for supplies and equipment for Marine Corps forces deployed in the Pacific region during World War II. In 1943, the Marine Corps Depot began providing logistical support to the Marine Corps commands throughout the western United States and Pacific region. MCLB Barstow's industrial operations were conducted at Nebo Main Base until the early 1960s, when they were relocated to Yermo Annex.

Yermo Annex was acquired in 1946 when mission requirements outgrew Nebo Main Base operations. Hazardous waste generation and disposal operations associated with industrial activities began at Yermo Annex in 1961, when a 10-acre central repair shop (Building 573) was built to provide repair and rebuilding capabilities.

The rifle range located at Nebo Main Base was acquired in the mid-1950s. Since that time, it has been used primarily for small arms practice (BNI 1998a).

1.2.3 Base Mission

The mission of MCLB Barstow is to provide quality logistical support to Fleet Marine Forces, Department of Defense (DoD) agencies, and other military organizations by receiving, maintaining, repairing, and storing military supplies and equipment. MCLB Barstow also trains new Marines in the logistical skills of warehousing.

1.2.4 Previous Investigations

The Navy conducted a series of studies at MCLB Barstow as part of the Navy Assessment and Control of Installation Pollutants program to determine the presence of contamination in soil and groundwater. An initial assessment study (IAS) was conducted to evaluate past practices of hazardous waste handling, storage, and disposal and to identify areas representing a potential threat to human health and the environment. The IAS identified 33 potential sites of contamination through record searches, employee interviews, and site surveys. These sites are currently referred to as CAOCs.

Five of the 33 CAOCs were judged to pose a potential threat to the environment and were recommended for further evaluation through a confirmation study. Another six were later included in the confirmation study based on additional evidence of potential contamination. Confirmation studies were completed for CAOCs 2, 3, 5, 9, and 11 at Nebo Main Base and 17, 18, 19, 21, 23, and 34 at Yermo Annex. These studies revealed elevated levels of chlorinated hydrocarbons, polychlorinated biphenyls (PCBs), pesticides, and metals in soils. Elevated levels of chlorinated hydrocarbons were reported in groundwater. Groundwater is the sole source of drinking water at Yermo Annex and surrounding communities (BNI 1998a). The U.S. EPA prepared a Hazard Ranking System (HRS) document for MCLB Barstow that included results from these confirmation studies along with water quality data from the United States Geological Survey and Southern California Water Company (U.S. EPA 1986).

During sampling and analysis of groundwater at the base in October and November 1988, trichloroethene (TCE) was reported in drinking water wells YDW-3 and YDW-5 at Yermo Annex. These three drinking water wells had been used for pumping groundwater since the 1960s. The TCE concentrations reported in YDW-3 exceeded the *California Code of Regulations* Title 22 drinking water standards for public water systems. Volatile organic compounds (VOCs) were also reported in the groundwater at several other monitoring wells at Yermo Annex (IT 1988). Yermo Annex presently relies on water supply wells on the base. The groundwater is treated through a carbon filtration system prior to domestic use. Nebo Main Base receives drinking water from the city of Barstow.

Based on the U.S. EPA HRS score and the fact that groundwater is the sole source of drinking water for the city of Barstow and surrounding areas, U.S. EPA placed MCLB Barstow on the National Priorities List on 15 November 1989 (Comprehensive Environmental Response, Compensation, and Liability Act ID No. CA8170024261). On 24 October 1990, the DON and MCLB Barstow entered into an FFA with the U.S. EPA, DTSC, and RWQCB Lahontan Region. At the time of the FFA, the number of CAOCs identified at Nebo Main Base and Yermo Annex had increased to 36. All 36 CAOCs are currently being addressed under the base CERCLA program (BNI 1998a).

A Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) was initiated in 1991 to comply with the schedule set forth in the 1990 FFA. The RFA process at MCLB Barstow included the following steps for identifying releases or potential releases that may require further action or investigation (BNI 1998a).

Section 1 Introduction

- A preliminary review (PR), completed in 1991, focused primarily on evaluating existing information such as inspection reports, permit applications, and historical monitoring data; conducting interviews with personnel who were familiar with the facility; and reviewing historical aerial photographs of the base.
- A visual site inspection (VSI), completed in 1991, entailed collecting visible on-site information to obtain additional evidence of releases.
- A sampling visit investigation was conducted in two phases to fill data gaps that remained upon completion of the PR and VSI. Field activities included soil sampling, geophysical surveys, soil gas surveys, and radiological surveys. Phase I at underground storage tank (UST) sites (28 solid waste management units [SWMUs]) was conducted in 1991. Phase II at 67 other SWMUs and areas of concern (AOCs) was conducted in 1994 and 1995.

A total of 247 SWMUs and AOCs were identified at MCLB Barstow during the PR and VSI, and 95 of these were recommended for inclusion in the sampling visit investigation. The soil sampling results obtained through the sampling visit investigations were then used to conduct a human-health risk evaluation. Both carcinogenic risks and noncarcinogenic hazards were addressed. Areas with an incremental risk (i.e., excluding background) of greater than 1×10^{-6} were evaluated regarding the need for further action. In addition, potential impacts of contaminated soil to groundwater were quantitatively evaluated using designated-level methodology screening (Marshack 1989). Petroleum hydrocarbon concentrations in soil were screened against site-specific California leaking underground fuel tank (LUFT) criteria (CA LUFT 1989).

Based on the findings of the RFA, the 247 identified sites were separated into groups based on what regulatory program process or permit the site was being managed under and whether sites were recommended for no further action or further investigation in the extended RFA (ERFA). The sites were categorized as follows. (Because portions of several SWMUs and AOCs are listed in different groups, the total number of sites in groups 1 through 6 appears to be 255, although the actual number of individual sites remains 247.)

- Group 1: Petroleum-only LUFT UST sites (52 SWMUs including 104 USTs).
- Group 2: RFA sites recommended for no further action in the PR/VSI report (12 SWMUs and AOCs).
- Group 3: RFA sites fully addressed in the CERCLA OUs 1 through 6 (82 SWMUs and AOCs). These sites are separated from the RFA process to avoid duplication of investigation and effort completed under the CERCLA program.
- Group 4: RFA sites managed under other regulatory programs, processes, or permits (four SWMUs). This group includes one site (SWMU 9.11) regulated under an MCLB Barstow Hazardous Waste Facility permit and three small arms range sites regulated by the DoD (SWMUs 11.2 through 11.4).

- Group 5: RFA sites recommended for no further action based on the RFA findings subsequent to the PR/VSI report (88 SWMUs).
- Group 6: RFA sites requiring further investigation in the ERFA (17 SWMUs). Additional data were required at these sites prior to recommending no further action or further action.

As a result of the findings of the RFA, an ERFA was conducted from 2000 to 2001. The results of the ERFA are discussed in the respective attachment for each CAOC.

An ecological risk assessment (ERA) was performed as part of two MCLB Barstow remedial investigations (RIs) for OUs 3, 4, 5, and 6 (U.S. EPA 1996). Although the ERA did not specifically address the OU 7 CAOCs, the CAOCs identified in the two previous RIs either overlap or are near the OU 7 CAOCs addressed in this RI.

The ERA identified four major habitat types at MCLB Barstow: disturbed habitat (industrial or residential use), the Mojave wash, the riparian fringe, and the upland creosote bush/scrub. The ERA concluded that low concentrations of contaminants in surface soils in portions of the upland creosote bush/scrub habitat at Nebo Main Base and the entire Yermo Annex did not appear to represent an immediate threat to the desert tortoise, critical or sensitive habitats, or migratory waterfowl and shorebirds due to the lack of quality habitat on those portions of MCLB Barstow (U.S. EPA 1996).

A limited supplemental investigation of off-site transport of contaminants from the Nebo Main Base CAOC 3 (golf course area) into the riparian fringe and Mojave wash habitats showed no evidence that on-base activities at CAOC 3 impacted soil or surface water in these habitats (U.S. EPA 1996). The landfill at CAOC 7 (which overlaps a portion of CAOC N-2 Area 1, one of the OU 7 CAOCs in this RI) was cited in the ERA as an area of ecological concern because it is adjacent to a quality creosote scrub community (to the south) that provides desert tortoise and reptile habitat. Protective measures were considered necessary for CAOC 7 (e.g., maintaining the perimeter fence, capping) (U.S. EPA 1996). CAOC 7 is currently capped and the area is fenced. In addition, a tortoise fence present around CAOC 7 helps prevent access to the site by desert tortoises.

The ERA recommended no additional ecological evaluation at MCLB Barstow until industrial uses of the base are discontinued. However, as indicated in a subsequent letter from DTSC, the ERA was conditionally accepted by the regulatory agencies and approval was "limited only to the currently known situation at MCLBB CERCLA Sites" (DTSC 1996). The letter further stated, "At a later date, additional information may be needed, or the errors and ambiguities may need to be improved, if new and/or expanded work is proposed for the CERCLA sites at MCLBB" (DTSC 1996).

Several OU 7 sites were identified and sampled after the ERA and were not included in the ERA. Two CAOCs (9.60 and 10) were included or were contiguous with the CAOCs evaluated in the ERA; however, additional samples have been subsequently collected. Therefore, it is recommended that the data from and chemicals identified at the OU 7 CAOCs be used to conduct a new ERA that includes all the OU 7 CAOCs.

Section 1 Introduction

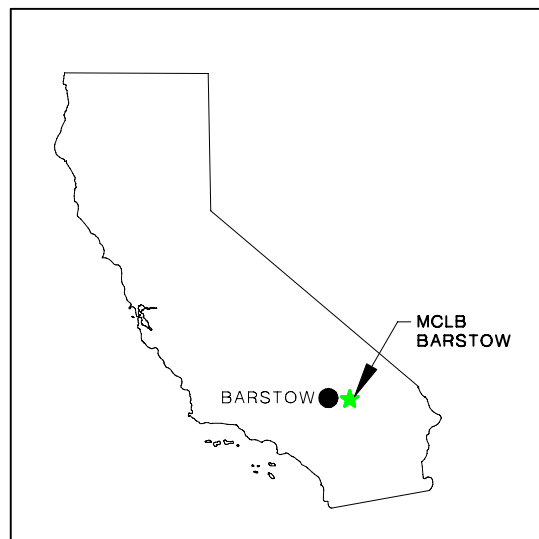
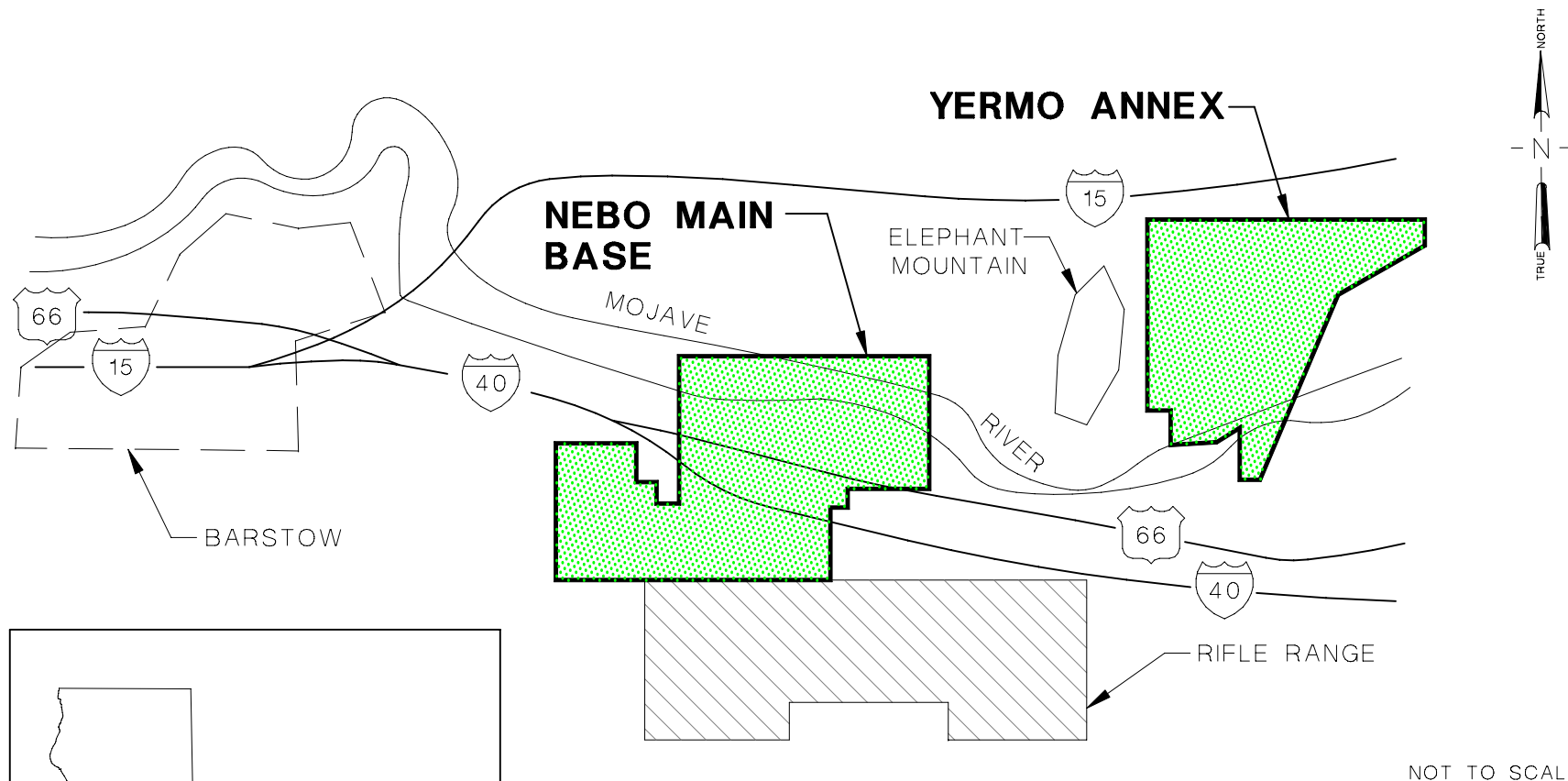
1.3 REPORT ORGANIZATION

The main sections of this report present the methods and findings common to all the OU 7 CAOCs. The attachments are stand-alone documents and present the individual results and conclusions for each OU 7 CAOC. The organization of each attachment mirrors the organization of the main report. The appendices present specific information to support the findings and conclusions presented in this report. The contents of this report, including attachments and appendices, are as follows.

- The Executive Summary presents an overview of RI activities, conclusions, and recommendations for all of the OU 7 CAOCs.
- Section 1, Introduction, provides an overview of this RI Report.
- Section 2, Study Area Investigation, presents sampling procedures and other field activities common to all the CAOCs.
- Section 3, Physical Characteristics of MCLB Barstow, discusses the physical characteristics (e.g., geology, topography) of the base as a whole.
- Section 4, Nature and Extent of Contamination, presents a general overview of sampling performed at the CAOCs.
- Section 5, Contaminant Fate and Transport, presents the fate and transport mechanisms common to all the CAOCs.
- Section 6, Human-Health Risk Assessment, presents risk assessment procedures common to all the CAOCs.
- Section 7, Conclusions and Recommendations, presents an overview of the conclusions and recommendations for all the CAOCs.
- Section 8, References, provides the references used to prepare the RI Report.
- Attachment A addresses CAOC 9.60.
- Attachment B addresses CAOC 10.27.
- Attachment C addresses CAOC 10.35.
- Attachment D addresses CAOC 10.37.
- Attachment E addresses CAOC 10.38/10.39.
- Attachment F addresses CAOC N-2 Area 1.
- Attachment G addresses CAOC 10.
- Appendix A contains field change notices.
- Appendix B presents aerial photographs.
- Appendix C presents well and boring survey data.
- Appendix D contains monitoring well, soil boring, and trench logs.
- Appendix E presents laboratory analytical results from Agriculture and Priority Pollutant Laboratory, Inc., along with chains of custody.

- Appendix F discusses and provides data validation reports.
- Appendix G provides geotechnical laboratory reports and chains of custody.
- Appendix H presents detailed information for the baseline human-health risk assessments (HHRAs).
- Appendix I is the leaching potential analysis for gasoline and diesel information (pertinent to CAOC 9.60) from the CA LUFT Manual (CA LUFT 1989).
- Appendix J presents results of a geophysical investigation at CAOC 10 (Spectrum 2002)

Figures and tables are presented at the end of each section of the main RI Report and the attachments.



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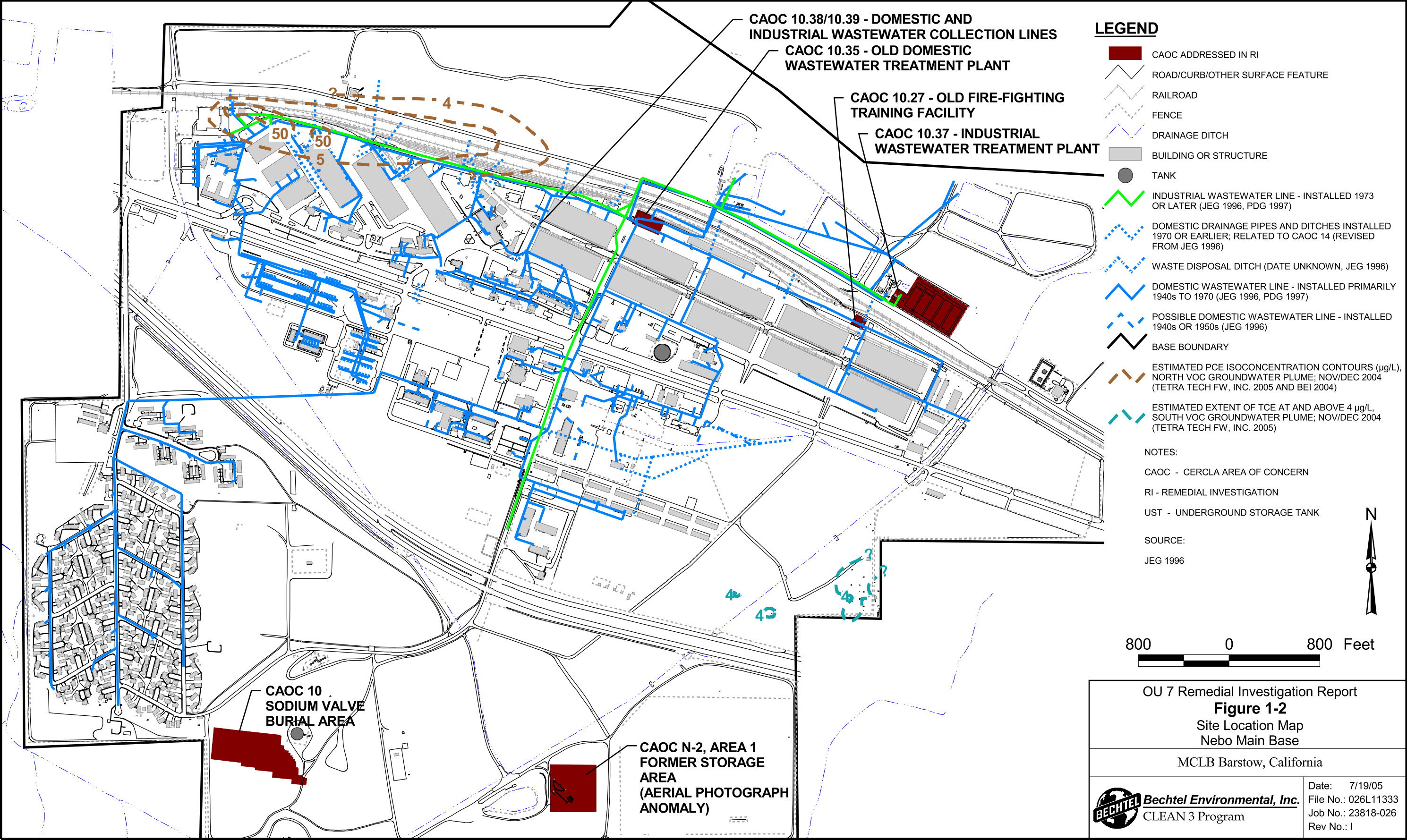
OU 7 Remedial Investigation Report
Figure 1-1
Site Vicinity Map
Marine Corps Logistics Base Barstow

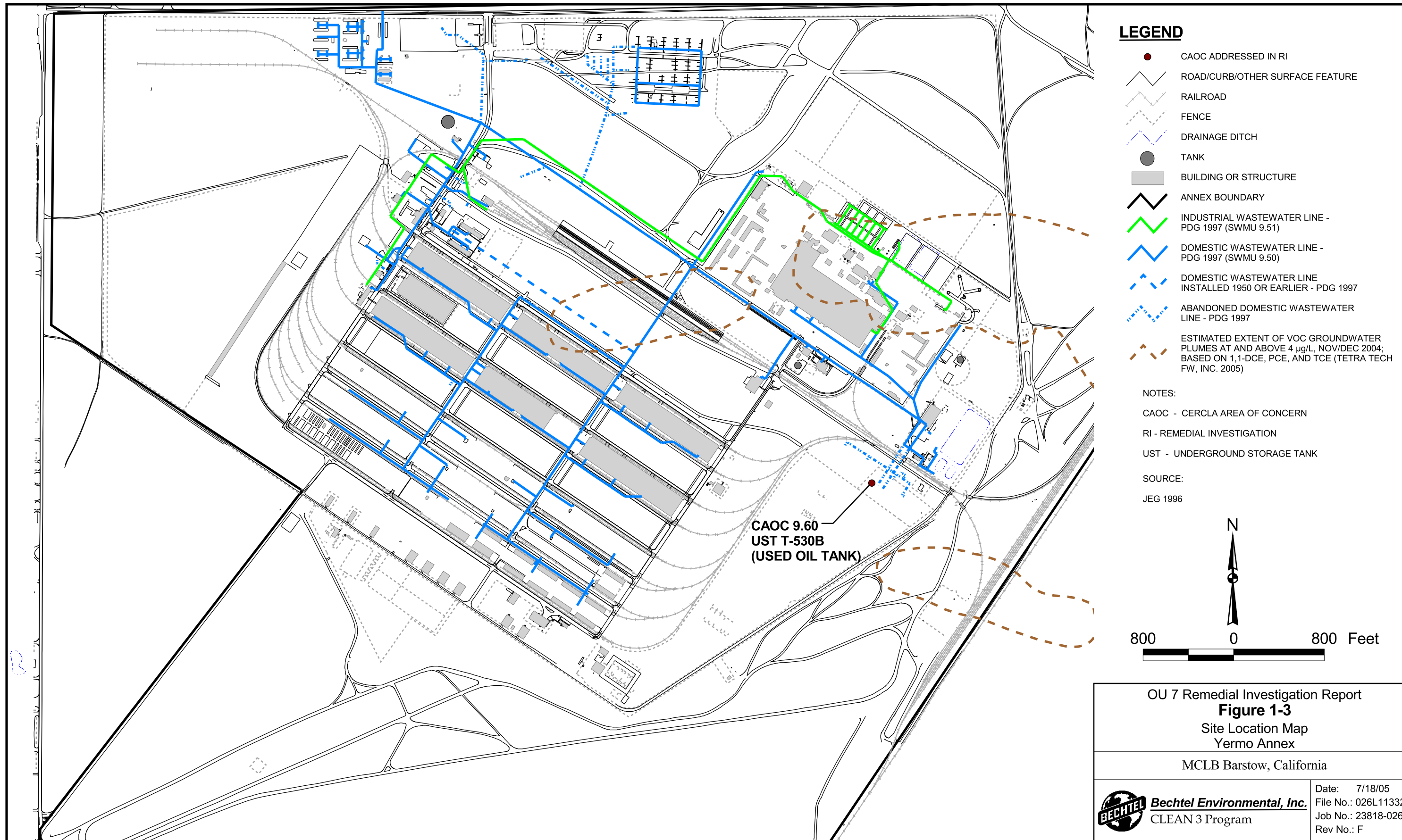
MCLB Barstow, California

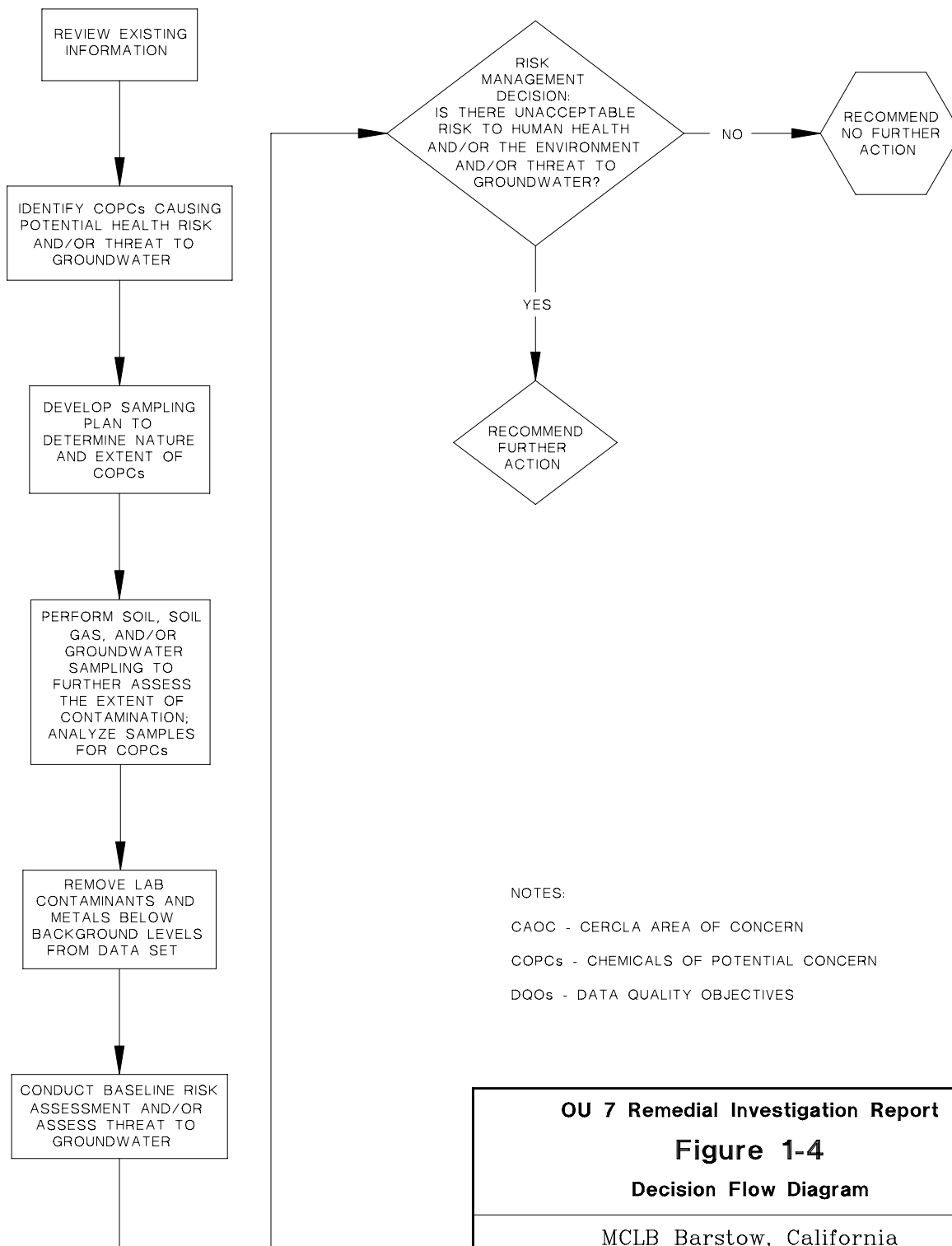


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 CLEAN 3 Program

Date: 5/17/04
 File No: 026R11335
 Job No: 23818-026
 Rev No: D







FOR SPECIFIC CAOC DQOs SEE INDIVIDUAL SECTIONS

OU 7 Remedial Investigation Report

Figure 1-4

Decision Flow Diagram

MCLB Barstow, California



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CLEAN 3 Program

Date: 6/2/04
File No: 026C11334
Job No: 23818-026
Rev No: D

**Table 1-1
Operable Unit 7 CAOCs**

CAOC	Description/Previous Activities	Location	RI Strategy	Attachment*
9.60	Former location of UST T-530B, a 40,000-gallon-capacity UST reportedly used by the Defense Reutilization and Marketing Office to store used oil and other waste liquids. UST T-530B was removed in 1992.	Yermo Annex	The RI sampling strategy was to collect soil and groundwater samples from within the former UST excavation to complete the characterization of soil and groundwater and confirm or deny the presence of DPN. Three borings were advanced to approximately 168 feet bgs, two borings were advanced to approximately 25 feet bgs, and one monitoring well was installed to approximately 176 feet bgs. Soil gas samples were collected at 5 feet bgs and then at 10-foot intervals to total depth in the borings for VOCs. Soil samples were collected at 0 foot bgs and then at 5-foot intervals to total depth in the 168-foot borings, and at 15, 20, and 25 feet bgs in the 25-foot borings, and selected samples were analyzed for SVOCs, metals, and TPH. Discrete groundwater samples were collected from the 168-foot borings and sampled for VOCs, SVOCs, and TPH. This sampling included analyzing soil samples for DPN within the former UST excavation to confirm or deny the presence of this contaminant. A baseline HHRA was conducted to determine the appropriate action (no further action or remedial action) for the CAOC.	A
10.27	Former location of the Old Fire-Fighting Training Facility, Building S-338, used for fire-fighting smoke training activities from the mid-1960s until 1975. The building was demolished sometime after the RFA visual site inspection in 1990.	Nebo Main Base	The RI sampling strategy was to collect soil samples from five soil borings near the area of the inactive drainpipes to complete the CAOC characterization. One boring was advanced to approximately 4 feet bgs, three borings to approximately 10 feet bgs, and one boring to approximately 30 feet bgs (into groundwater). A discrete groundwater sample was collected from the 30-foot boring for SVOCs and lead analysis. Soil samples were collected and analyzed for SVOCs, dioxins/dibenzofurans, and lead. Soil samples were collected at the surface or near surface and then at 5-foot intervals to total depth. A baseline HHRA was conducted to determine the appropriate action (no further action or remedial action) for the CAOC.	B
10.35	Former location of Nebo Main Base Old DWTP, which operated from 1942 until approximately 1978 when the New DWTP was brought on-line. The plant treated sanitary and industrial wastewater from a variety of Nebo Main Base operations.	Nebo Main Base	The RI sampling strategy was to collect soil and groundwater samples from one soil boring near the location of former RFA soil boring 10.35-3, and three other soil borings (two at the clarifiers) to complete the CAOC characterization. The boring near 10.35-3 was advanced to approximately 34 feet bgs (into groundwater). The other three borings were advanced to approximately 12 feet bgs. Soil samples were collected at 0 foot bgs and then at 5-foot intervals to total depth in the deeper boring, and at 0, 5, and 12 feet bgs in the shallower borings. A soil sample was also collected at the soil-water interface. A discrete groundwater sample was collected from the	C

(table continues)

Table 1-1 (continued)

CAOC	Description/Previous Activities	Location	RI Strategy	Attachment*
10.35 (continued)			deeper boring. The soil and groundwater samples were analyzed for SVOCs, PCBs, pesticides, and TAL metals (soil only). A baseline HHRA was conducted to determine the appropriate action (no further action or remedial action) for the CAOC.	
10.37	The IWTP, constructed in 1975, treated wastewater generated by industrial operations such as painting, cleaning, preservation and packaging, steam cleaning, and vehicle maintenance. The IWTP includes the wet well, five evaporation ponds, two sludge-drying beds, an air flotation unit, a ferrous chloride tank, and a used oil UST. Operation of the plant was discontinued in March 1990.	Nebo Main Base	The RI sampling strategy was to collect soil samples from nine borings and soil gas samples from seven borings to complete the CAOC characterization. The soil borings were advanced into the subsurface to delineate areas of PAHs, PCE, and TPH as diesel (particularly PAHs). The contaminants in the TPH and PAH areas were generally limited to less than 5 feet bgs. Therefore, soil samples were collected at 0, 3, and 5 feet bgs from six shallow borings. These soil samples were analyzed for SVOCs and TPH. Four borings were advanced in the area of the elevated PCE concentrations to approximately 30 feet bgs and three borings were advanced to approximately 15 feet bgs in areas near the ponds not previously investigated. Soil gas samples were collected at 5-foot intervals from these seven soil borings to delineate the PCE contamination, and soil samples were collected at approximately 0 foot bgs and then at 5-foot intervals from the 15-foot borings and were analyzed for SVOCs and TPH. The soil gas samples from these borings were analyzed for VOCs. A baseline HHRA was conducted to determine the appropriate action (no further action or remedial action) for the CAOC.	D
10.38/10.39	The domestic (CAOC 10.38) and industrial (CAOC 10.39) wastewater collection lines were installed beginning in 1942 at the start of operations at Nebo Main Base. Use of all industrial wastewater collection lines was discontinued in May 1998. In 2000, the drains, which were connected to the industrial wastewater collection lines, were sealed and plugged with concrete to prevent possible discharge. Industrial waste is now collected and disposed off-base. The domestic system is currently active. In the past the domestic	Nebo Main Base	The RI sampling strategy was to collect and analyze soil, soil gas, and groundwater samples for VOCs from approximately 15 locations to complete the CAOC characterization (address whether the industrial and/or domestic wastewater collection lines have significantly impacted soil or groundwater at Nebo Main Base). The strategy divided the industrial and domestic lines into segments based on common connections. This strategy was used to minimize the number of samples collected but maximize the value of the results. The strategy included a review of all previous sampling information around the lines and locations of breaks identified by the closed-circuit TV camera survey to help establish the proposed new boring locations. Soil gas, soil, and groundwater samples were collected from the boring locations based on data needs for each segment. The boring locations were investigated using a tiered sampling approach. The purpose of Tier 1 sampling was to assess whether	E

(table continues)

Table 1-1 (continued)

CAOC	Description/Previous Activities	Location	RI Strategy	Attachment*
10.38/10.39 (continued)	collection line had received some industrial waste. All industrial connections to the domestic system were removed by the mid-1980s.		contamination was present at each sampling location. Tier 2 was further sampling of soil if contamination was found based on Tier 1 sampling. Tier 2 sampling was not necessary. For data evaluation and decision purposes, the line segments were grouped into seven units (1 through 7). A baseline HHRA was conducted to determine the appropriate action (no further action or remedial action) for the CAOC.	
N-2 Area 1	Consists of a former open storage area (used to store equipment and vehicles), most of a skeet/trap shooting range, and a portion of CAOC 7, Stratum 2. The portion of CAOC 7, Stratum 2, contained within N-2 Area 1 has been capped in concurrence with the OUs 5 and 6 ROD. Therefore, this area is protective of human health and environment and will not be addressed in the RI. The RFA indicated that wastewater and oils had been used for dust suppression at CAOC N-2 Area 1. Also, petroleum oils may have leaked onto the ground surface during vehicle storage.	Nebo Main Base	The RI sampling strategy consisted of collecting soil samples at three locations and sampling at 0.5 to 1 foot bgs to complete the CAOC characterization. One boring was drilled west of the landfill cap in an area where clay target fragments were found to assess whether the fragments are the source of the elevated PAHs. The other borings were drilled in the vicinity of elevated PAH concentrations. All three borings were advanced with a hand auger. The ground surface at each boring location was cleared of visible clay target fragments prior to sample collection. All three samples were analyzed for SVOCs and PCBs. In addition, a sample of the clay target fragments was collected from the ground surface near one of the three soil sampling locations. This sample was analyzed for SVOCs and PCBs to assess whether the clay target fragments contain the types and concentration of PAHs and PCBs previously reported at the CAOC. A baseline HHRA was conducted to determine the appropriate action (no further action or remedial action) for the CAOC.	F
10	In the late 1950s, between 3,000 and 5,000 sodium-filled steel and bronze valves were buried approximately 10 feet bgs in the southwest corner of Nebo Main Base. The valves themselves were not considered likely to pose a threat; however, it was thought that other materials, including hazardous waste, might have been disposed with the valves. During construction of the CAOC 35 landfill cap in 2000, sodium valves suspected to be related to CAOC 10 were uncovered in the borrow area for the landfill cap material. This area is located approximately 300 feet east of the	Nebo Main Base	The RI sampling strategy consisted of sampling both geophysical anomalies and the area outside these anomalies separately. The geophysical anomalies were investigated using trenching. The areas outside of the geophysical anomalies were addressed via statistically based sampling at random locations. At these locations subsurface soils were investigated using a tiered sampling approach. This approach consisted of three tiers. The purpose of Tier 1 sampling was to collect sufficient data so that an HHRA could be conducted and an associated risk management decision made within project-defined probabilities for CAOC 10. The Tier 1 statistically based sampling approach consisted of collecting soil samples from 0 foot and 5 and 12 feet bgs at 22 random sampling locations within CAOC 10. In addition, soil gas samples were collected from 5 and 12 feet bgs at each of the 22 locations. Tiers 2 and 3 would focus on refining contamination data identified by the Tier 1 sampling. Tier 2 sampling was not necessary.	G

(table continues)

Table 1-1 (continued)

CAOC	Description/Previous Activities	Location	RI Strategy	Attachment*
10 (continued)	Nebo Main Base housing. Other materials uncovered with the valves at CAOC 10 included metal debris and an unidentified canister. A geophysical survey conducted in April 2002 identified eight anomalous areas at CAOC 10. These areas will be addressed separately from the remainder of the CAOC.		<p>In addition to tiered sampling of nonanomalous areas, trenching and associated sampling activities were performed in the eight anomalous areas (identified in the geophysics survey) to assess the nature (cause) of these anomalies at CAOC 10. Twelve trenches were excavated into the eight geophysical anomalies. Soil samples were collected from one location at 0 foot and 5 and 12 feet bgs in each trench. After trenching and sampling were completed, the excavated materials were backfilled into the trench. After a trench was backfilled, the area was then graded back to the condition present before trenching.</p> <p>All soil samples at CAOC 10 were submitted to a fixed-based laboratory for analysis of SVOCs, pesticides and PCBs, herbicides, dioxins/dibenzofurans, and TAL metals. Soil gas samples were collected at 5 and 10 feet bgs at each statistically based sampling location. All soil gas samples were analyzed for VOCs.</p>	

Note:

- * attachment to this RI Report that presents CAOC-specific information

Acronyms/Abbreviations:

bgs – below ground surface
 CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
 DPN – n-nitroso-di-n-propylamine
 DWTP – domestic wastewater treatment plant
 HHRA – human-health risk assessment
 IWTP – industrial waste treatment plant
 PAH – polynuclear aromatic hydrocarbon
 PCB – polychlorinated biphenyl
 PCE – tetrachloroethene
 RFA – Resource Conservation and Recovery Act facility assessment
 RI – remedial investigation
 ROD – record of decision
 SVOC – semivolatile organic compound
 TAL – target analyte list
 TPH – total petroleum hydrocarbons
 UST – underground storage tank
 VOC – volatile organic compound

Section 2

STUDY AREA INVESTIGATION

This section describes general procedures used to complete the RI for the OU 7 CAOCs. These procedures were designed to address the CAOC-specific DQO decisions identified for the RI. (For CAOC-specific information, see Attachments A through G.) The field investigation was performed in accordance with the Work Plan. The sampling and quality assurance procedures discussed in this section conform to federal, state, and local guidelines and appropriately address the DQOs (BEI 2003).

Procedural changes from the Work Plan were documented using Field Change Notices (FCNs). Table 2-1 summarizes FCNs related to the OU 7 RI. Copies of the FCNs are presented in Appendix A.

RI activities were conducted from March 2003 through August 2003 and were monitored or performed by CLEAN 3 project personnel. Data collected during the RI sampling augmented the results of previous investigations conducted at the OU 7 CAOCs (see Section 1.2.4 for a summary of previous investigations). The DQO decisions rules used at the OU 7 CAOCs are discussed in Attachments A through G. The types of media sampled at each CAOC during the RI are shown in Table 2-2. Activities performed during the RI included land surveying, geophysical surveying, trenching, soil gas sampling, soil sampling, and groundwater sampling. Sampling procedures are discussed briefly in this section.

2.1 STANDARD OPERATING PROCEDURES

Field activities were performed in accordance with the following CLEAN 3 Standard Operating Procedures (SOPs) (BNI 2003):

- SOP 3, Borehole Logging
- SOP 4, Soil Sampling
- SOP 5, Monitoring Well Design, Installation, and Development
- SOP 6, Instrument Calibration and Use
- SOP 7, Water and Free Product Level Measurement in Wells
- SOP 8, Groundwater Sampling
- SOP 9, Sample Containers, Preservation, and Handling
- SOP 10, Sample Custody, Transfer, and Shipment
- SOP 11, Decontamination of Equipment
- SOP 13, Destruction of Boreholes and Wells
- SOP 16, gINT System: Borehole and Well Log Data Entry
- SOP 17, Logbook Protocols
- SOP 18, Developing Data Quality Objectives
- SOP 22, Investigation-Derived Waste Management
- SOP 28, Field Change Request

CAOC-specific RI sampling results are provided in Section 4 of each attachment.

2.2 AERIAL PHOTOGRAPH REVIEW

Aerial photographs were reviewed for each of the OU 7 CAOCs and are discussed in Attachments A through G. Aerial photographs reviewed for this RI are presented in Appendix B.

2.3 UTILITY SURVEY

A utility clearance survey was conducted before subsurface activities were initiated. The survey included the following activities.

- Geophysical methods (e.g., electromagnetic induction, magnetometry, and ground-penetrating radar) were used to clear proposed sampling locations for potential subsurface obstructions prior to borehole advancement.
- MCLB Barstow utility maps were reviewed.
- MCLB Barstow dig permits were submitted and approved.
- Underground Service Alert of Southern California was notified; meetings were held with all interested parties who were potentially affected by drilling and/or trenching activities.

Before fieldwork was begun, surface geophysical results were analyzed to define sample locations and optimize sampling strategies. To increase the margin of safety, hand-augering to approximately 5 feet below ground surface (bgs) was attempted at each location prior to mechanical borehole advancement. This was not feasible at all locations due to site or lithologic conditions (hand-auger refusal). A maximum of three attempts were made to hand-auger to 5 feet bgs at each location. An FCN (195) was prepared to document this deviation from the Work Plan (Table 2-1). A CLEAN Program geologist was present on-site to monitor the utility clearance.

2.4 LAND SURVEY

All borings, groundwater wells, and trench locations were surveyed by a registered land surveyor at the conclusion of the RI field effort (Appendix C). The groundwater monitoring well locations are accurate to plus or minus 0.01 foot vertically and to plus or minus 0.1 foot horizontally. Soil boring locations and the trench boundaries are accurate to plus or minus 0.5 foot vertically and plus or minus 0.01 foot horizontally. All points were surveyed for location and elevation relative to mean sea level and were referenced to the North American Datum 1983 (location) and National Geodetic Vertical Datum 29 (elevation).

Section 2 Study Area Investigation

2.5 SAMPLING SUMMARY

The investigations at OU 7 CAOCs were designed so that when data collected during previous investigations and data collected during the RI were evaluated together, the nature and extent of chemicals of potential concern (COPCs) could be estimated and an HHRA could be conducted individually for each CAOC. The basis and methodology for the number of boring locations and associated samples collected at these locations are outlined in the Work Plan (BEI 2003). Figures 2-1 and 2-2 show the locations of the previous investigation and RI sampling locations at the OU 7 CAOCs.

Historical site activities, previous site investigation results, and regulatory agency comments were used to formulate the RI sampling approach. The primary objective of the RI was to assess the extent of contamination and human-health risk to determine whether a decision of remedial action or no further action would be appropriate. The sampling approach to address this objective included conducting one phase of sampling to fill data gaps at CAOCs 9.60, 10.27, 10.35, 10.37, and N-2 Area 1. A phased approach was proposed for CAOCs 10.38/10.39 and 10; however, only the first phase of sampling was necessary to complete site characterization at these two CAOCs.

To provide resource-effective soil sampling, two different types of sampling designs were used during the RI:

- judgmentally based sampling – sample locations are selected using professional judgment and experience or geophysical signature; statistical analysis is not involved
- statistically based sampling – the number of sample locations is selected using a statistical sampling approach; the samples are randomly located

CAOCs 9.60, 10.27, 10.35, 10.37, 10.38/10.39, and N-2 Area 1 were sampled using a judgmental sampling design. Sampling at CAOC 10 was conducted using both judgmental and statistical sampling designs. The Work Plan addresses these two sampling designs in detail. Table 2-3 summarizes the total number of sample locations and samples collected at each CAOC during the RI. The following subsections present a summary of sampling activities conducted during the RI.

2.5.1 Soil Gas Sampling

Soil gas samples were collected from all boreholes where VOCs were to be analyzed (Table 2-3). These include selected boreholes at CAOCs 9.60, 10.37, 10.38/10.39, and 10. The soil gas samples were collected to assess the potential presence of vapor-phase VOCs in subsurface soil. A direct-push drilling rig or hollow-stem auger (HSA) drilling rig equipped with a soil gas sample probe was used, and sample collection was according to the Technical Specification for Soil Gas Monitoring (BNI 1995).

The type of drill rig used to collect soil gas samples was dependent on CAOC-specific conditions. When a direct-push rig was used and soil samples were also collected at a given location, the soil gas samples were collected from a separate borehole drilled adjacent to the borehole for the soil samples. This was necessary since the direct-push rig

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used separate sampling devices for soil and soil gas that required withdrawal of the push rods from the borehole to change devices. When a HSA was used, the soil gas and soil samples were collected from the same borehole with a SimulProbe® sampling device, which is capable of simultaneously collecting soil and soil gas samples in one sampling attempt.

Samples were obtained at designated depths with a HSA by advancing the SimulProbe into undisturbed soil below the bottom of the borehole, then partially retracting the probe assembly to expose the sample intake screen. Prior to advancing the sampling device, all tubing and connections were inspected and sealed. Before sample collection, the system was purged using a vacuum pump. The purging process was monitored with a flow meter to measure volume. Organic vapor concentrations in soil gas samples were measured using a flame ionization detector or photoionization detector (PID). Purging continued until the entire sampling system volume had been purged. Samples were collected in dual black-layered Tedlar™ bags to reduce the potential for photodegradation of any light-sensitive constituents that might be present. A new, unused bag was used for each sample.

At each of the sampling depths, the annulus was sealed using bentonite Hydrogel® to mitigate the potential for ambient air that may be in the borehole to enter the sampling equipment. The process for accomplishing this was as follows.

- At each sample depth, the augers were pulled back a few feet to expose the soil.
- Then a thick bentonite clay slurry, consisting of Hydrogel and water, was poured inside the augers, filling the open portion of the boring and several inches up inside the auger.
- This dense slurry created an immediate barrier between the auger atmosphere and the soil below.
- Finally, the SimulProbe was installed through the slurry to approximately 10 inches below the bottom of the boring and retracted a few inches to expose the screened sampling port so a sample could be collected.

To determine whether breakthrough of the bentonite Hydrogel seal had occurred, a leak test with an isobutylene tracer gas was performed during purging of the sampling system. Isobutylene was introduced into the auger through a second tubing (not attached to the SimulProbe) open at a few feet above the bentonite Hydrogel seal. Purging commenced after the auger was filled to approximately 2 feet above the seal (based on blow rate and volume estimates) with isobutylene at 5 parts per million (ppm). Purged gases were monitored using a PID, and a breakthrough was considered evident if readings stabilized at 5 ppm. Leak tests were performed randomly at 53 sample points, corresponding to 15 percent of soil gas samples collected. In each case, PID readings did not indicate a leak had occurred during purging. In addition, nine soil gas samples collected during leak testing were also laboratory analyzed for isobutylene. The results of these samples indicated no reported detections of isobutylene, further confirming the results of the leak testing.

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2.5.2 Soil Sampling

Soil samples were collected from soil borings and trenches at the depths specified in Table 2-3. Boring and well construction logs and trench logs are provided in Appendix D. Soil samples were collected in accordance with SOP 4 (BNI 2003). Samples were submitted under chain of custody (Appendix E) to Agriculture and Priority Pollutant Laboratory, Inc. (APPL), or Environmental Geotechnical Laboratory, Inc., for laboratory analysis. Analytical results and data validation reports are provided in Appendices E and F, respectively. The analytical testing schedule for nonaqueous matrices is summarized in Table 2-4.

Soil matrix parameters were also collected in association with soil gas samples (for use in modeling risk). If appropriate soil matrix parameters were not available from previous investigations at a particular CAOC, then one or more soil samples were collected from representative lithologic layers at that CAOC. Analyses included bulk density, total organic content, soil moisture, effective air permeability, porosity, and grain-size distribution.

Logging was performed in accordance with procedures outlined in SOP 3. The soils were logged in accordance with the Unified Soil Classification System by, or under the direction of, a California-registered geologist. The final borehole logs were reviewed and approved by a California-registered geologist.

Soil samples for lithologic logging were collected from drill cuttings, split-spoon samplers, or direct-push core barrels. Soil samples for laboratory analyses were collected using a California split-spoon sampler, core barrel, or SimulProbe.

2.5.2.1 HAND AUGER

Soil samples from hand-auger borings were collected using a hand-driven core sampler fitted with stainless steel or acetate sleeves at borehole locations advanced to a total depth of 5 feet bgs or less. Soil samples submitted to a laboratory for chemical analyses were collected in the stainless steel or acetate sleeves.

The field geologist determined the actual depth interval and the number of sleeves collected for each sample based on CAOC-specific conditions and analytical volume requirements. After sampling, each hand-auger borehole was backfilled with soil material, bentonite, or neat cement.

2.5.2.2 DIRECT PUSH

Soil samples were collected using a direct-push drilling rig equipped with a standard 1- to 1.5-inch-diameter core-barrel sampler. The sampler was fitted with stainless steel or acetate sleeves to facilitate sample collection and shipment to the laboratory. Soil collected in the sleeves was used for lithologic logging purposes or for chemical analyses.

In cases where CAOC-specific subsurface lithologic conditions (e.g., gravel layers) prevented direct-push sampling of a borehole to the planned total depth, the boring was backfilled and relocated to a step-out location approximately 3 to 5 feet away but within

the area previously cleared of underground utilities. The sampler was advanced and lithologic logging of this second location was performed until the target depth was reached. Depending on site field conditions, up to three attempts were made to successfully advance the direct-push boring at each location before the direct-push sampling effort for that location was abandoned. A hollow-stem auger drill rig was used to advance borings and conduct sampling to the specified depth at locations where direct-push sampling failed.

The number of soil samples and sample collection depths for the direct-push boreholes are described in the CAOC-specific Attachments A through G. The field geologist determined the actual depth interval and number of sleeves collected for each sample based on CAOC-specific conditions and analytical volume requirements.

After sampling was complete, the borehole was filled completely with an approved sealing material, using an approved method as defined in California Department of Water Resources (DWR) Bulletin 74-90 and SOP 13. DWR-approved sealing materials include bentonite, neat cement, or a bentonite-cement mixture (DWR 1991).

2.5.2.3 HOLLOW-STEM AUGER

HSA drilling utilized a truck-mounted drilling rig equipped with hollow-stem, continuous-flight augers, and a modified California or standard penetration test sampler (split-spoon sampler). The drilling method refers to use of a continuous-flight and lead auger with a cutter head at the bottom. As the cutter head rotates and advances the hole, the soil cuttings are lifted to the surface on the flights.

Once the borehole was advanced to a designated sample depth, soil samples were collected with the split-spoon sampler. The sampler, attached to the appropriate drive-weight assembly, was positioned through the augers at the bottom of the borehole and driven into undisturbed material by repeated blows of a 140-pound hammer free falling 30 inches, in general accordance with American Society for Testing and Materials D1586. The number of hammer blows required to advance the sampler through each 6-inch increment was recorded on the borehole log in the field logbook. The split-spoon sampler was fitted with stainless steel sleeves to facilitate sample collection and shipment to the laboratory. Soil collected in the sample sleeves was used for lithologic logging purposes and for chemical analysis. Drill cuttings were used for lithologic logging purposes in borings where soil sampling was not conducted.

The number of soil samples and sample collection depths for the HSA boreholes are described in the CAOC-specific Attachments A through G. The field geologist determined the actual depth interval and the number of sleeves collected for each sample based on CAOC-specific conditions and analytical volume requirements.

After sampling was complete, the borehole was filled completely with an approved sealing material using the augers as a tremmie, according to an approved method as defined in DWR Bulletin 74-90 and SOP 13. DWR-approved sealing materials include bentonite, neat cement, or a bentonite-cement mixture (DWR 1991).

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2.5.2.4 TRENCHING

Trenching was performed at CAOC 10 to evaluate the nature and extent of contamination in anomalous areas identified by a geophysical survey. Trenches were excavated to depths from 7 to 12 feet below ground surface (bgs) using a backhoe equipped with a 20-inch bucket. Soil removed from each trench was temporarily stored on the ground adjacent to the excavation. The materials exposed in each trench were examined and photographed, and their locations were recorded on a trench log (Appendix D). Once the examination was complete, each trench was backfilled with the excavated material and leveled to the original grade. Wastes encountered during trenching were temporarily staged on plastic sheeting and replaced to the approximate depth encountered. Soil sampling was conducted at approximately 0 foot, 5 feet, and 12 feet bgs. If wastes did not extend to 12 feet bgs, the deepest soil samples were collected above 12 feet bgs. See Section 2 in Attachment G for details on soil samples collected within the trenches at CAOC 10.

2.5.3 Groundwater Monitoring Well Installation and Development

One groundwater monitoring well was installed during the RI. This well was constructed inside the HSAs with 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) casing at CAOC 9.60. The well construction diagram is presented in Appendix D.

The total well depth was based on appropriate historical and current data. Well 9.60-MW1 was constructed with 0.10-inch, slotted, 15-foot-long PVC well screen positioned approximately 8 feet above and 7 feet below the water table. The monitoring well was constructed in general accordance with SOP 5.

Depth to groundwater was measured in the well before and after both well development and purging. Presampling measurements were taken a minimum of 24 hours following well development to allow groundwater levels to stabilize. Groundwater levels were measured using an electronic water-level meter in accordance with SOP 7.

2.5.4 Monitoring Well and Discrete Groundwater Sampling

The following sections summarize groundwater sample collection using a discrete sampling point (SimulProbe or HydroPunch®-type device) or temporary wellpoint (TWP), and from one groundwater monitoring well. Samples were submitted to APPL for laboratory analysis. The complete analytical testing schedule for groundwater samples is summarized in Table 2-5.

All samples were collected in the appropriate laboratory-provided containers and were labeled in accordance with the procedures in Section 2.9. Immediately following collection, each sample container was sealed in a plastic bag and placed in an ice-filled cooler until packaged for shipment to the laboratory.

After sampling was complete, boreholes were filled completely with an approved sealing material using the augers or direct-push drive casing as a tremmie, using an approved method as defined in DWR Bulletin 74-90 and SOP 13. DWR-approved sealing materials include bentonite, neat cement, or a bentonite-cement mixture (DWR 1991).

2.5.4.1 SIMULPROBE DISCRETE GROUNDWATER SAMPLE COLLECTION

Groundwater samples were collected from two hollow-stem auger boreholes via a SimulProbe at CAOC 10.38/10.39. The SimulProbe consists of a core barrel and water canister fluidly connected via Teflon[®] riser tubes. The probe is pressurized and then lowered to the desired location in the borehole and driven approximately 21 inches to collect a soil core that can be correlated to the groundwater sample. The probe is then pulled 2 to 3 inches to retract the sliding drive shoe and expose the circular screen. A valve at the surface is opened, allowing the canister to depressurize and groundwater to flow into the canister. Once the canister has filled with water, it is repressurized, raised to the surface, and depressurized again. The groundwater sample is collected by inserting a short tube into a reed valve on the bottom of the water canister.

2.5.4.2 HYDROPUNCH-TYPE DISCRETE GROUNDWATER SAMPLE COLLECTION

Groundwater was collected from direct-push boreholes via a discrete, HydroPunch-type groundwater sampler at CAOCs 10.27 and 10.38/10.39. These groundwater samples were retrieved at varying depths from selected direct-push borings. Once a borehole was advanced to the depth designated for sampling, the discrete sampler was lowered to the bottom of the borehole, the hydraulic/percussion drive-point of the sampler was pushed downward into undisturbed soil to the desired sampling depth, and the sampling device was partially retracted to expose the screened interval and allow groundwater to flow through the screen into the sampling tip. Groundwater was retrieved by pumping it to the surface through single-use Teflon tubing using a peristaltic pump (at a low flow rate to minimize volatilization of potential organic contaminants) or by bailing with small-diameter disposable bailers. Groundwater samples were collected directly into laboratory-supplied sample containers. The discrete groundwater sampler had a sacrificial point that was left in place as the screen assembly was pulled to the surface once sampling was completed.

2.5.4.3 TEMPORARY WELLPOINT GROUNDWATER SAMPLE COLLECTION

Groundwater was collected via TWPs at CAOCs 9.60 and 10.35. This alternative method was implemented at these CAOCs instead of discrete sampling (Sections 2.5.4.1 and 2.5.4.2) due to site-specific conditions that made discrete sampling problematic. An FCN documenting this change from the Work Plan is presented in Appendix A (Table 2-1).

The TWP groundwater samples were retrieved from the saturated zone from selected HSA borings. Once the total depth of the boring was reached, a TWP was set inside the boring by placing a well screen across the water table, with the bottom of the screen at approximately 3 to 4 feet below the top of the water table. The TWP was constructed with a 2-inch-diameter, Schedule 40 PVC casing with a 5-foot, 0.010-inch-slotted screen. The augers were then pulled back approximately 5 feet to expose the screen, allowing groundwater to flow into the TWP. The water level was measured, and once sufficient groundwater was available, groundwater samples were retrieved with a disposable bailer. Groundwater samples were transferred directly into laboratory-supplied sample

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containers. Immediately following sampling, the TWP casing and screen were removed from the boring and the boring was abandoned by filling it with cement-bentonite grout.

2.5.4.4 MONITORING WELL GROUNDWATER SAMPLE COLLECTION

Groundwater samples were collected from the well installed at CAOC 9.60 during the RI. Prior to sampling, the well was gauged for depth to groundwater, total depth, and presence of any floating free product. Prior to sampling, the well was purged in accordance with SOP 8 guidelines for well purging.

Purging and sampling were conducted using a variable-speed Grundfos® Redi-Flo2® electric submersible (or equivalent) pump. The discharge tubing used to convey water from the pump outlet to the discharge point at ground surface was new, clean polyethylene tubing dedicated to use only in a specific well to minimize the potential for cross-contamination.

In preparation for purging, the pump and associated electrical wiring were thoroughly decontaminated prior to use. The pump was then lowered into the well. The purge rate was maintained at or below the recharge capability of the aquifer. During purging, field monitoring parameters (i.e., pH, water temperature or electrical conductivity [EC], and turbidity) were measured and recorded. Measurement of the field monitoring parameters continued until pH readings were within 0.5 of the two previously recorded values and measurements of temperature and EC stabilized within 10 percent of the two previously measured values for each parameter. Purging was considered complete when the field parameters stabilized and a minimum of 3 well volumes of groundwater had been removed. When these conditions were met, the required samples were collected. The purge record is presented in Appendix D.

Groundwater samples for laboratory analysis were collected according to the provisions of SOP 8. Groundwater samples were collected from the discharge end of the pump tubing or from a disposable bailer. All field measurements, observations, and calculations were recorded on the Water Sampling Record in the field logbook.

2.6 DECONTAMINATION OF SAMPLING EQUIPMENT

Sampling equipment was cleaned and decontaminated according to SOP 11. The following summarizes the decontamination steps.

- Large equipment (e.g., drilling equipment) was decontaminated using a steam or pressure washer capable of delivering water at a minimum temperature of 180 °F.
- Small equipment was decontaminated between sampling locations by the following steps.
 1. Wash with low or nonphosphate detergent (e.g., Alconox® or Liqui-Nox® solutions made up as directed by the manufacturer).
 2. Rinse with potable water.

3. Rinse with deionized or distilled water.
4. Rinse again with deionized or distilled water.

Water generated during equipment decontamination was containerized at each CAOC in United Nations (UN)-approved 55-gallon drums. Each drum was clearly labeled to indicate the source of the contents.

2.7 DISPOSAL OF INVESTIGATION-DERIVED WASTE

All investigation-derived waste (IDW) generated during the field investigation was containerized, stored, and disposed of according to contract requirements, SOP 22, and methods described in the Work Plan (BEI 2003). The types of IDW generated from the RI field activities included soil cuttings from boreholes and soil sampling, drilling and sampling equipment decontamination water, well purgewater, disposable sampling equipment, and used personal protective equipment (PPE).

Solid IDW (e.g., soil) was placed in covered, portable roll-off bins lined with plastic sheeting or in UN-approved 55-gallon drums. Liquid IDW was stored separately in UN-approved 55-gallon drums. Contaminated PPE and sampling equipment were also placed in covered UN-approved 55-gallon drums. Noncontaminated PPE and nonhazardous construction debris were placed in industrial waste bins.

Each container was clearly labeled to indicate the waste source. Before disposal or shipment off-site, containers were labeled with appropriate Department of Transportation identification and classification information by the waste disposal subcontractor. Decontamination wastewater and well development and purgewater were transported to Yermo Annex for treatment at the groundwater treatment system. MCLB personnel were responsible for selecting the methods/location of IDW disposal and for signing all manifests.

2.8 HEALTH AND SAFETY

RI activities were performed in accordance with the Site-Specific Safety and Health Plan Supplement (SSHP) (BEI 2003). One FCN (195) relating to health and safety issues was approved during the RI activities and is summarized in Table 2-1.

In accordance with the SSHP, underground utility clearance was performed for intrusive work to reduce the potential for damaging utilities and compromising personal health and safety. Geophysical surveys of all sampling locations were conducted prior to starting work, and Underground Services Alert was contacted at least 48 hours before beginning intrusive activities.

In addition to CLEAN requirements, Dig Permits and Activity Hazard Analyses were prepared in accordance with MCLB Barstow requirements prior to initiation of field activities.

Daily safety tailgate meetings were held by the Site Safety and Health Representative (SSHR) to discuss safe work practices. All work was supervised by an SSHR and all field activities included exclusion zone and contamination-control measures.

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2.9 QUALITY ASSURANCE

The following subsections discuss the various components of the QA procedures followed during the RI sampling activities. These components consisted of the following:

- sample collection
- sample custody/documentation
- field QC procedures
- data verification and validation

2.9.1 Sample Collection

Each sample was collected and handled according to the field methods and procedures described in the Sampling and Analysis Plan (SAP) (BEI 2003) and applicable SOPs. Proper sampling techniques and procedures were used to obtain samples of consistent quality and reduce the potential for sample misrepresentation and unreliable analytical data. The sampling procedures followed are outlined in this section.

2.9.1.1 SAMPLE CONTAINERS

Sample container selection was conducted in accordance with SOP 9 and the Work Plan (BEI 2003). Soil sample sleeves and associated plastic end caps were provided by the drilling contractor and were inspected for cleanliness prior to use.

Soil gas samples to be analyzed for VOCs were collected in 1-liter, dual black-layered Tedlar bags via disposable Teflon tubing. Sample containers were manufactured by and obtained from SKC, Inc., with headquarters in Pennsylvania.

Groundwater samples for VOC and total petroleum hydrocarbons (TPH) as gasoline analyses were collected in 40-milliliter volatile organic analysis (VOA) vials. Groundwater samples for pesticides, PCBs, semivolatile organic compounds (SVOCs), and TPH as diesel analyses were collected in 1-liter amber glass bottles. The laboratory performing the analyses provided sample containers for all water analyses.

2.9.1.2 SAMPLE PACKAGING AND SHIPPING

Samples shipped to the selected project laboratory were accompanied by the appropriate sample transfer and shipment paperwork as described in SOP 10. Chain-of-custody (COC) forms and custody seals were used to document possession and help prevent tampering of samples during shipment to the laboratory. The field investigation crews prepared all samples for shipment to the laboratory via common carrier, per the procedures specified in the applicable SOPs. Samples were packaged properly and dispatched to the designated laboratory (or laboratories) for analysis. The method of shipment, courier name, and other pertinent information were entered on the COC forms.

Field teams packaged the samples for shipment as follows.

1. A sample label was attached to each sample container.
2. A custody seal was placed on each sample container.

3. All glass containers were wrapped in foam sheeting or bubble wrap and placed in zip-lock bags.
4. All coolers were packed with ice (except soil gas samples) that was double bagged to prevent leakage during shipment.
5. Completed COC forms were placed in a plastic zip-lock bag and taped to the inside of the cooler lid.
6. The coolers were secured with strong strapping tape and custody seals.
7. At the end of each day or when a cooler was filled, the field crew shipped the samples to the laboratory via project vehicle and common carrier.

Sample shipment by delivery courier (e.g., soil gas samples) was in accordance with SOP 10.

2.9.2 Sample Custody/Documentation

Each sample or field measurement was properly documented to facilitate timely, correct, and complete analysis, and to support use of data in the analysis and conduct of remedial actions. The documentation system provides the means to identify, track, and monitor each sample from the point of collection through final data reporting. A variety of documentation methods were used, including site assessment forms, field and data logbooks, sample labels, COC records, custody seals, and electronic databases. Details of the specific documentation methods used are described in the SAP (BEI 2003) and SOPs 10 and 17.

2.9.2.1 FIELD LOGBOOKS AND RECORDS

Controlled, prepaginated, and permanently bound logbooks were used to record field observations and measurements to provide a permanent record of daily field activities. The logbooks contained various forms for this purpose, including daily field reports, geologic borehole logs, well purging and sampling records, groundwater-level records, contractor production reports, field sketches, and photodocumentation.

Entries were legible and written in indelible ink. Corrections consisted of line-out deletions that were initialed and dated by the person making the correction. All entries were signed and dated, and the remaining space on each page was crossed out. Completed field logbooks were delivered to the CLEAN Program Document Control Center in San Diego. Other forms used to record field safety and health-related data were not bound into field logbooks but were instead maintained in project files and folders. Logbook procedures are described in SOP 17.

2.9.2.2 SAMPLE LABELING

A label was affixed to every sample container. The label included the following:

- project number, U.S. EPA Contract Laboratory Program (CLP) case number, and special analytical services number (if applicable)
- sampling location

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- CLP sample number (if available) and CLEAN sample number
- collector's initials (not preprinted)
- collection date and time
- type of preservations for each analysis
- analyses to be performed
- any special instructions

Detailed sample custody, transfer, and shipment procedures are in SOP 10.

2.9.2.3 CUSTODY SEALS

After samples were collected, custody seals were placed on the sample containers. The seal was placed so that it had to be broken to open the sample container. Two or more custody seals were placed on the outside of the shipping container or cooler prior to shipment by overnight carrier. Each custody seal affixed to sample containers and sample coolers was signed and dated by the sample team leader or designee.

2.9.2.4 SAMPLE IDENTIFICATION NUMBERS

Unique sample ID numbers and station descriptions were assigned to each sample location. The ID number was on the sampling container when it was shipped to the laboratory for analysis. The ID number and the station description were recorded on the sample form in the sampling logbook, on the sample label, and on the COC record. This was done carefully so that there was no uncertainty about the location and identity of each sample. No two samples were assigned the same ID number.

Sample ID numbering conformed to the standard CLEAN Program scheme to assure that all ID numbers were consistent with the data input requirements for the Bechtel Environmental Integrated Data Management System. This numbering scheme uses a 9-digit alphanumeric code consisting of the following.

- First is a 3-digit number (e.g., 026) equivalent to the assigned CTO number of the project preceded by the letter "C" to identify the sample as a CLEAN 3 sample.
- Second is a 4-digit alphanumeric code that is unique to this project sampling event. For the RI, the code started with a single letter that was assigned to a specific CAOC, followed by a 3-digit, numeric representation of the sample number (i.e., 001 through 999) depending on the number of samples collected. This alphanumeric code was also used to distinguish between sample media (soil, soil gas, or groundwater). A range of numbers from the 3-digit numeric code was assigned based on sample media:
 - 001–199, soil
 - 200–399, soil gas
 - 400–599, groundwater
 - 600–699, geotechnical

- Third is a 2-digit, numeric representation of the sample collection container (e.g., 01) to provide a basis for distinguishing between multiple containers submitted for different analyses under a single sample ID number (e.g., containers for VOCs, SVOCs, PCBs, or TPH).

As an example for CTO-0026, the 24th soil sample collected from CAOC 9.60 (letter designation "A") during the RI in the second of three stainless steel or acetate sleeves (container number 02) would be identified as sample number **C026A02402**.

2.9.2.5 CHAIN-OF-CUSTODY RECORDS

The COC record documents the transfer of sample custody from the time of sampling to laboratory receipt. SOP 10 describes COC procedures. COC forms were completed by the sampler and accompanied the samples from the field to the analytical laboratory.

The custody record was completed using waterproof ink. All corrections were made by drawing a line through, initialing, and dating the error, and then entering the correct information. Erasures were not permitted. All applicable information on the COC record, including signatures, was filled out completely and legibly. Unused space (rows) for sample/analysis information were crossed out, initialed, and dated. Samples requiring different turnaround times were not included together on the same COC record. If samples were delivered to the laboratory by an overnight carrier, the airbill number was recorded, and the COC record(s) were placed in a waterproof plastic bag taped to the lid inside the sample cooler prior to sealing.

Once samples were received at the laboratory, laboratory personnel were responsible for acknowledging receipt of samples, recording the temperature within the shipping cooler, and verifying that the containers were not opened or damaged. Laboratory personnel were also responsible for maintaining custody and sample tracking records throughout sample preparation and analysis. A copy of the COC record was sent to the CLEAN Program office at the completion of analytical work.

2.9.3 Field Quality Control Procedures

Quality control (QC) data were gathered during sampling to assess the precision and accuracy of the results. Sampling procedure quality was monitored using three types of QC samples: field duplicates, trip blanks, and field blanks (which included source blanks and equipment rinsate samples).

2.9.3.1 FIELD DUPLICATE SAMPLES AND ANALYSES

Field duplicates are two samples of the same matrix, collected at the same location and time (to the extent possible), with an assumed level of overall homogeneity within the sample matrix. The same sampling techniques and analytical methods are performed on both samples. Analysis of field duplicates provides a quantitative measure of the precision of the overall sampling and analysis process as the sum of contributions from sample heterogeneity, the precision of the sampling process, and the analytical method(s).

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Because of the inherent heterogeneity in soil samples, a distinction should be made between a field duplicate and a field replicate. A field replicate is a second soil sample collected at the same location and time (to the extent possible). A field duplicate is generated (in the field) from homogenization and splitting of a larger sample, much the same as the generation of a laboratory duplicate. Laboratory duplicates are not a substitute for field duplicates. Field replicates, compared to field duplicates, are a better measure of inherent sample heterogeneity. At each OU 7 CAOC, replicate soil, soil gas, and groundwater samples were collected and analyzed at the rate of one replicate per ten samples submitted to the laboratory for each type of analysis, or at a minimum, one replicate per analysis suite per CAOC if fewer than ten soil, soil gas, or groundwater samples were submitted for a particular analysis.

2.9.3.2 BLANK SAMPLES

A variety of QC blank samples were used to assess the potential for sample contamination during the sampling and analysis processes. Laboratory QC samples used for assessing the impact of contamination on sample results include method blanks, calibration blanks, instrument blanks, and refrigerator storage blanks. The laboratory used these QC sample types in accordance with U.S. EPA method-specific requirements, Section 4.11 of the Laboratory Technical Specification, (BNI 1998b), and the Installation Restoration Chemical Data Quality Manual (NFESC 1999). In addition, four kinds of field QC blanks were used: trip blanks, equipment rinsate blanks, source water blanks, and field blanks (or ambient blanks).

Trip blanks were used to detect contamination introduced during sample handling and shipment. Trip blanks were prepared by the laboratory using contaminant-free reagent-grade water and were shipped to the field together with sample containers. They were not opened in the field and were returned to the laboratory in every sample cooler containing soil or groundwater samples to be analyzed for VOCs.

An equipment rinsate blank is a sample of contaminant-free water that has been passed through or over recently decontaminated field sampling equipment. The equipment blank was used to assess the adequacy of the equipment decontamination process, as well as contaminant effects from handling, storage, shipment, and analysis. Equipment rinsate blanks were prepared by the sample team at a minimum of one set (for all parameters of concern) per day during soil and groundwater sampling activities.

Source water blanks were used to assess the potential for sample contamination from the final rinsewater of the decontamination process. One blank from each source water location (or vendor) was collected and analyzed for the same parameters as the related soil and groundwater samples.

Field blanks (or ambient blanks) were samples of contaminant-free water prepared by pouring source water into the same type of container (preserved as appropriate) as actual field samples. Field blanks were prepared at or near the location of actual sampling and were analyzed for potential contaminants from the ambient air. One field blank was prepared at Nebo Main Base and one at Yermo Annex (one site), since ambient conditions throughout MCLB are generally the same (FCN 190; Table 2-1).

2.9.4 Data Management

Project data consisted of various types of information, ranging from field measurements to laboratory analyses. CAOC data requirements for this project were governed by the specific type of data and the DQOs. Unique data type combinations were available to accommodate specific data collection and reporting needs for this project.

Primary data management activities included establishing sampling design; collecting, encoding, verifying, and validating data; performing quality assurance (QA)/QC evaluation of data; and generating output. The data management staff shares responsibility for high-quality products with CTO staff.

Data management procedures were established by the CLEAN Program Data Management Plan (DMP) (BNI 1993). Project-specific modifications were incorporated into the Project DMP (BEI 2003).

2.9.4.1 DATA VERIFICATION

Field and laboratory data were managed using manual and electronic systems. Data stored, evaluated, and reported electronically were subject to 100 percent manual verification against hard copy data reports. Discrepancies were corrected and documented following the CLEAN Program DMP (BNI 1993).

2.9.4.2 DATA VALIDATION

Laboratory data were validated in accordance with the CLEAN Program Technical Specification for Data Validation Services (BNI 1998b) by a validation subcontractor, independent of the laboratory. The data validation process consists of a systematic assessment and verification of data quality through independent review. Validation was performed by individuals who are not associated with the collection and analysis of samples, interpretation of sample data, or with any decision-making process within the scope of the particular investigation. For the CLEAN Program, this was accomplished through the use of independent, third-party data validation subcontractors. Data validation procedures were in accordance with U.S. EPA guidance for the CLP, modified as necessary to accommodate non-CLP methods.

The terminology for levels of data validation has changed because the previous Naval Energy and Environmental Support Activity guidance (NEESA 1988) has been replaced by the Installation Restoration Chemical Data Quality Manual (NFESC 1999), which does not define levels of data validation. For the CLEAN Program, the former Level C data validation process (NEESA 1990) will be referenced as Level III data validation, and the former Level D process (NEESA 1990) will be referenced as Level IV data validation. Level III and Level IV data validation requirements and criteria are described in the Technical Specification for Data Validation Services (BNI 1998b) and the SWDIV Environmental Work Instruction No. 1 (SWDIV 2001).

Level IV data validation follows the U.S. EPA protocols and CLP criteria set forth in the functional guidelines for evaluating inorganic and organic analyses (U.S. EPA 1994, 1999). Calculations are checked for QC samples (e.g., matrix spike/matrix spike

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duplicate and laboratory control sample data) and routine field samples (including field duplicates, field and equipment rinsate blanks, and VOC trip blanks). To assure that detection limit and data values are appropriate, an evaluation is made of instrument performance, method of calibration, and the original data for calibration standards.

For a Level III data validation effort, the data values for routine and QC samples are generally assumed to be correctly reported by the laboratory. Data quality is assessed by comparing the QC parameters listed above to the appropriate criteria (or limits) as specified in the project SAP, by CLP requirements, or by method-specific requirements (e.g., CLP, SW-846).

The fixed-base laboratory data were subjected to a data validation strategy appropriate to the intended use of the data. An independent third-party subcontractor performed a Level III data validation on 80 percent of the fixed-base laboratory data. The remaining 20 percent of the data received a Level IV data validation. The sample data that received Level IV validation were selected randomly to obtain a representative data set unless a review of the first round of sampling data suggested focused data validation of specific parameters or specific sample locations. Field measurement results were reviewed as appropriate to the project DQOs and analytical data measurement objectives.

2.9.4.3 DATA VALIDATION QUALIFIERS

RI analytical data were qualified based on data validation reviews. For chemical data, qualifiers were assigned in accordance with the acceptable U.S. EPA National Functional Guidelines for Data Validation (U.S. EPA 1994, 1999). Analytes with the following characteristics were then removed from the list of detected chemicals as follows:

- every concentration reported as being unusable (“R” qualified)
- analytes identified as acetone, methyl ethyl ketone, methylene chloride, toluene, or a phthalate ester (common laboratory contaminants) with every concentration reported as being less than 10 times the concentrations in associated blanks
- analytes identified as any other chemical with every concentration reported as being less than 5 times the concentration in associated blank samples

Data that were assigned an “R” qualifier were not used for any purpose (including, but not limited to, risk assessment, data interpretation, tables, and figures).

2.9.4.4 DATA USES

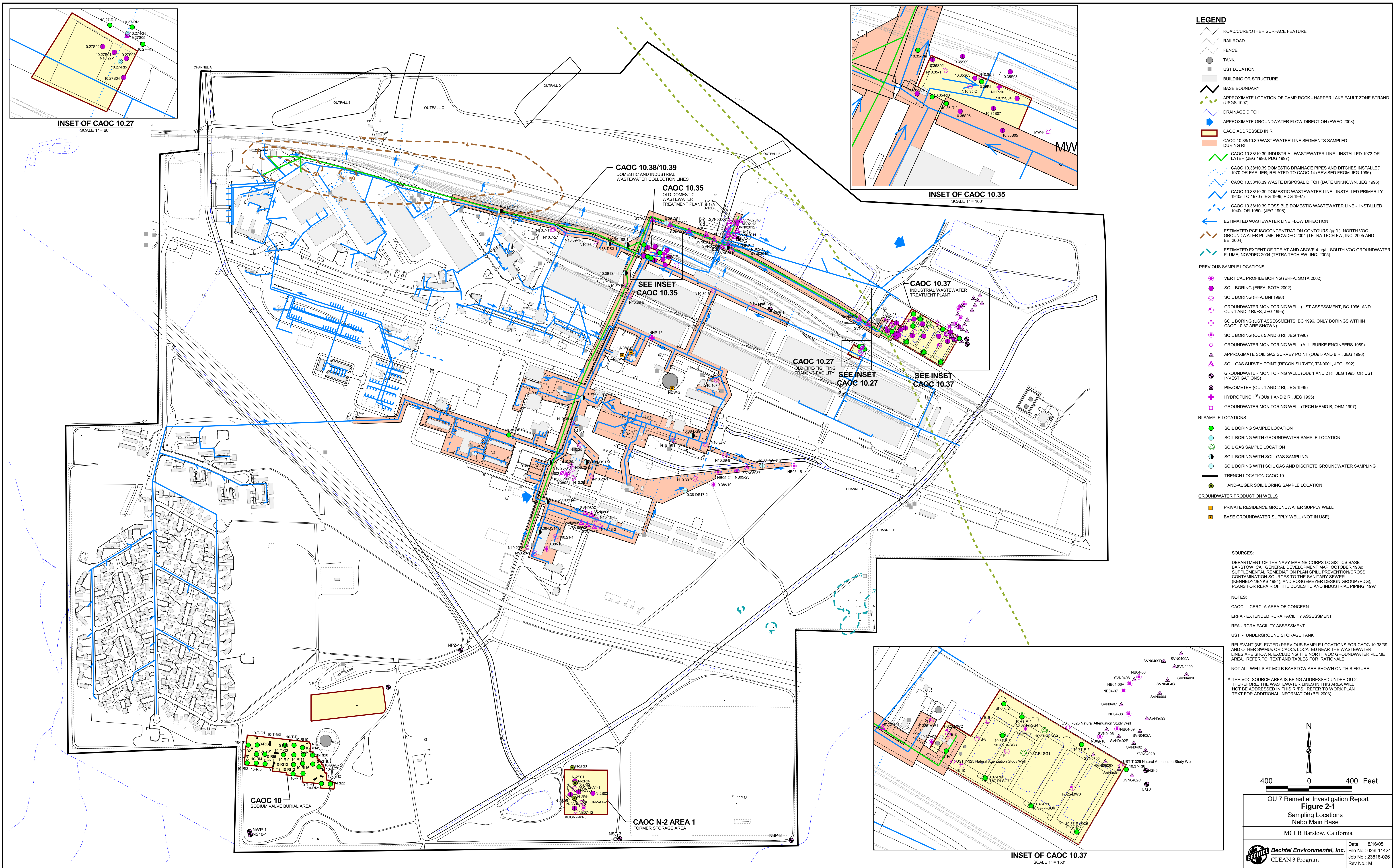
Following the DQOs established for the OU 7 RI, the analytical results are used for several distinct purposes. These data uses include:

- evaluation of physical conditions of the CAOC (e.g., geophysical properties),
- evaluation of nature and extent of contaminants, and
- evaluation of risks to human health.

2.10 ANALYTICAL METHOD DETECTION LIMITS

Each analytical method used during the RI had both a detection limit and a method reporting limit. A method reporting limit is typically higher than the lowest concentration that the analytical instrument can detect with a 99 percent certainty (detection limit). Concentrations of analytes below the method reporting limit and above the instrument detection limit were flagged by the laboratory with a “J” qualifier as estimated values. As a result, J-flagged reported concentrations were lower than the lowest calibration standard and above the detection limit. For soil gas, soil, and groundwater samples, the laboratories provided detection limits that varied depending on the matrix and concentration of chemicals present in each sample, resulting in various reporting limits depending on the matrix. Tables 2-6 and 2-7 list the range of detection limits achieved for analytes reported in soil and groundwater and compare them to preliminary remediation goals (PRGs) and maximum contaminant levels (MCLs), respectively. A table is not provided for soil gas detection limits, as there are no soil gas screening criteria.

Table 2-6 lists each soil analyte for each chemical analytical method used during the RI. The 2004 residential PRGs are also included in Table 2-6. For soil, 25 analytes had maximum detection limits in some of the samples that exceeded the residential PRGs (due to matrix interference). However, the minimum detection limits for samples (not requiring dilution and without matrix interference) reported by the laboratory were below the residential PRGs for all but three analytes. Table 2-7 lists each groundwater analyte and the reporting limit used during the RI. Four analytes had reporting limits above the MCL. One additional analyte had a reporting limit above the MCL due to matrix interference.



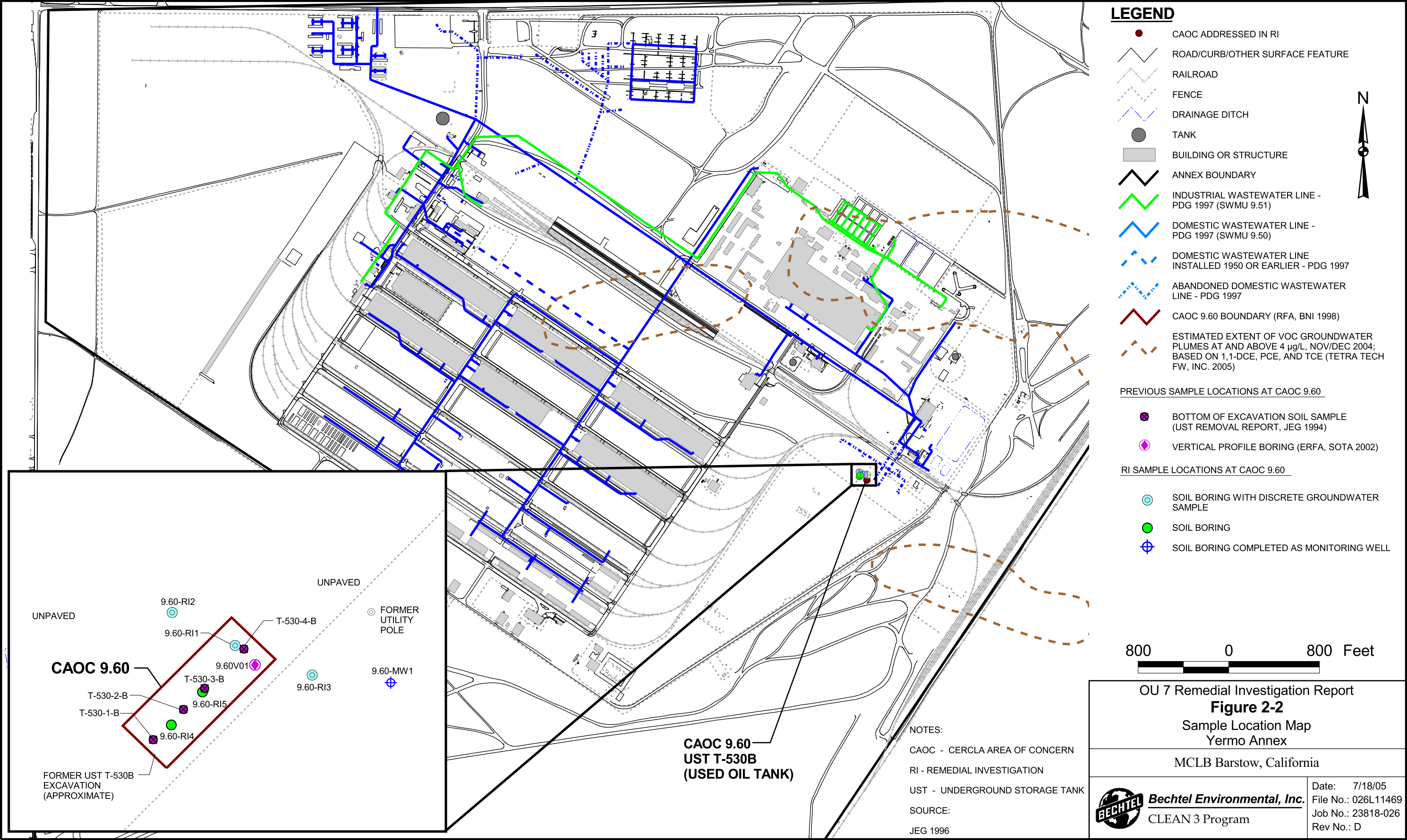


Table 2-1
Summary of OU 7 RI Field Change Notices

FCN No.	Description of Change	Reference
0188	Direct-push sample containers consist of clear plastic liners, not glass jars or stainless steel sleeves.	Table 4-1, Work Plan
0189	The number of direct-push attempts at a particular location should be made based on field conditions and will not necessarily include three attempts every time.	Section 4.1.4.2, Attachment A, SAP
0190	It is not necessary to collect a field blank at each CAOC as the CAOCs are no longer in operation and the ambient conditions throughout MCLB Barstow are generally the same. One field blank will be collected for each Nebo Main Base and Yermo Annex.	Section 5.2.3.2, Attachment A, SAP
0191	Sample container information for total organic carbon should be included so that this analysis can be conducted.	Tables 4-1 and 4-2, Work Plan
0192	Soil samples should be analyzed for TPH fuel fingerprint.	Tables 3-1, 3-4, and 3-11, Work Plan
0193	Soil lithology should be classified at all soil gas sampling locations not previously logged.	Section 4.1.5, Attachment A, SAP
0195	Depending on field conditions encountered at a particular location, it may not be possible to hand-auger to 5 feet bgs. A maximum of three attempts may be made to hand-auger to 5 feet bgs at each location.	Section 4.1.5, Attachment A, SAP
0197	Instead of the originally proposed location, boring DS14-3 was drilled at a location better suited to investigate potential industrial discharges from Building 196 to potentially leaking wastewater lines.	Figure 3-22, Work Plan Figure 3-5, Attachment A, SAP
0199	Groundwater sampling was conducted at additional depths in borings DS17-2 and DS17-3 at the request of the Navy RPM.	Section 3.5.7.2, Table 3-19 Work Plan Section 3.5, Table 3-10, Attachment A, SAP
0207	Groundwater sampling was conducted from temporary wellpoints at CAOCs 9.60 and 10.35 because insufficient groundwater was available by the proposed discrete groundwater sampling method.	Section 4.1.7.1, Work Plan Attachment A, SAP

Acronyms/Abbreviations:

bgs – below ground surface
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
FCN – field change notice
MCLB – Marine Corps Logistics Base
OU – operable unit
RI – remedial investigation
RPM – Remedial Project Manager
SAP – sampling and analysis plan
TPH – total petroleum hydrocarbons

Table 2-2
Types of OU 7 RI Sampling Media

CAOC	Media Sampled
9.60	soil gas, soil, groundwater
10.27	soil, groundwater
10.35	soil, groundwater
10.37	soil gas, soil
10.38/10.39	soil gas, soil, groundwater
N-2 Area 1	soil
10	soil gas, soil

Acronyms/Abbreviations:

CAOC – Comprehensive Environmental Response, Compensation,
and Liability Act area of concern

OU – operable unit

RI – remedial investigation

Table 2-3
Summary of OU 7 RI Sampling

CAOC	Number of Borings (depths)	Approximate Depth to Water (feet bgs)	SAMPLES						Analysis ^b – Medium
			SOIL GAS		SOIL		GROUNDWATER ^a		
			Total Number	Sample Depth (feet bgs)	Total Number	Sample Depth (feet bgs)	Total Number	Sample Depth (feet bgs)	
9.60	2 (25 feet bgs)	168.1	11	5, 10, 12, 20, 25; 1 duplicate sample at 25	6	15.2, 20.5, 25/25.4	— ^c	—	SVOCs, TPH (fuel fingerprint) – soil VOCs – soil gas
	3 (173 and 173.5 feet bgs)	162.5 to 169	63	5, 10, 12, 20, 25, 30; then every 10 feet from 30–160, and at 168; 3 duplicate samples at 12 and 90 (2)	66 ^d	0/0.1, 5/5.2, 10, 12/14, 20/22, 25.1/25.2, 30; then approximately every 10 feet from 30–160; and at 168.2 and 169.5; 4 duplicate samples at 20.5, 21.5, 61.7, and 90.2	3	168 to 169	SVOCs, TPH (fuel fingerprint), TAL metals (depending on location) – soil ^d VOCs – soil gas VOCs, SVOCs, TPH (fuel fingerprint) – groundwater
	1 (completed as monitoring well to 176 feet bgs)	168.1	—	—	—	—	2 ^e	168.1–176 (saturated screen interval)	VOCs, SVOCs, TPH gas – groundwater
10.27	1 (4.3 feet bgs)	35	—	—	4	0.8, 2, 3, 4	—	—	Lead, dioxins/dibenzofurans – soil
	3 (13 feet bgs)	35	—	—	10 ^f	0, 4.5 to 5, 10 to 11.5; 1 duplicate sample at 5	—	—	SVOCs, dioxins/dibenzofurans, lead – soil ^f
	1 (29.5 feet bgs)	35	—	—	9	0, 4.5, 10.5, 14, 20, 25, 28; 2 duplicate samples at 20.5 and 25.5	1	35	SVOCs, lead – groundwater SVOCs, dioxins/dibenzofurans, lead – soil
10.35	1 (38.5 feet bgs)	33.5	—	—	8	0.5, 5, 10, 14, 19.7, 25.1, 30.3; 1 duplicate sample at 19.2	1	33.5	SVOCs, PCBs, pesticides – soil SVOCs, PCBs, pesticides – groundwater
	3 (13 feet bgs)	33.5	—	—	8	0 to 0.5, 5, 10.1 to 10.5 (1 location at 0.5 and 11)	—	—	SVOCs, PCBs, pesticides, TAL metals – soil
10.37	6 (5.5 to 6 feet bgs)	35	—	—	20	0 to 0.75, 2.5 to 3, 3.5 to 5; 2 duplicate samples at 3.5	—	—	SVOCs, TPH (motor oil, diesel) – soil
	4 (30 to 31 feet bgs)	35	19	5, 10, 20, 29 to 30; 3 duplicate samples at 5, 20, and 29	—	—	—	—	VOCs – soil gas
	3 (15 to 17 feet bgs)	35	9	5, 10, 15 to 17	13 ^g	0.5, 4.5 to 5.5, 8.3 to 10.5, 14; 1 duplicate sample at 13.5	—	—	SVOCs and TPH (motor oil, diesel) – soil ^g VOCs – soil gas
10.38/10.39 ^h : North Nebo Area	5 (17.7 to 27.7 feet bgs)	25 to 36	16	7 to 17, 12 to 22, and 17 to 27 (3 per boring; depth varies by location); 1 duplicate sample at 24	17 ⁱ	7.8 to 17.5, 12.7 to 19.5, 17.1 to 27.2 (3 per boring; depth varies by location); 2 duplicate samples at 12.2 and 15.9	—	—	VOCs – soil gas SVOCs, PCBs, pesticides (depending on location) – soil ⁱ
	North Nebo Area (with groundwater)	1 (27 feet bgs)	2	22; 1 duplicate sample at 22	—	—	2	25	VOCs – soil gas VOCs – groundwater
	South Nebo Area (with groundwater)	2 (115 and 128.5 feet bgs)	85 to 126.5	7	10, 15, 20; 1 duplicate sample at 15	6 ⁱ	10.1, 16 to 16.3, 21 to 21.4	9	85 to 126.5; 1 duplicate sample at 107

(table continues)

Table 2-3 (continued)

CAOC	Number of Borings (depths)	Approximate Depth to Water (feet bgs)	SAMPLES						Analysis ^b – Medium
			SOIL GAS		SOIL		GROUNDWATER ^a		
			Total Number	Sample Depth (feet bgs)	Total Number	Sample Depth (feet bgs)	Total Number	Sample Depth (feet bgs)	
10.38/10.39 ^b : (cont.) South Nebo Area	7 (>6 to 23.5 feet bgs)	85 to 126.5	16	6 to 12, 11.5 to 17, 17 to 22 (3 per boring, except for 1 boring [1 sample]; depths vary by location)	21 ⁱ	6.1 to 11.2, 11.2 to 17.25, 18.3 to 23 (3 per boring, except for 1 boring [1 sample]; depths vary by location), 2 duplicate samples	—	—	VOCs – soil gas SVOCs, PCBs – soil ⁱ , at 10.38-DS12-1: TAL metals – soil ⁱ
N-2 Area 1	3 (0.2 foot bgs)	195	—	—	3	0	—	—	SVOCs, PCBs
	1 clay target sample (surface)	195	—	—	1	0	—	—	SVOCs, PCBs
10	12 (trench sampling locations)	165 to 200	—	—	38	0 to 12 (3 per trench; depth varies by location); 2 duplicate samples at 5	—	—	SVOCs, PCBs, pesticides, herbicides, dioxins/dibenzofurans, TAL metals – soil
	22 (12 to 14 feet bgs; random locations)	165 to 200	48	5 to 6, 10 (2 per boring); 4 duplicate samples	71 ^j	0 to 12 (3 per boring; depth varies by location; 1 deeper sample was at 13); 5 duplicate samples at surface and 11	—	—	SVOCs, PCBs, pesticides, herbicides, dioxins/dibenzofurans, TAL metals – soil ^j ; Soil duplicate sample at 10-RI-7: dioxins/dibenzofurans only VOCs – soil gas

- Notes:
- ^a HydroPunch[®] or equivalent sampling method was used for all groundwater samples except from the monitoring well at CAOC 9.60; those samples were collected using monitoring well sample collection techniques
 - ^b RI samples were analyzed using the following U.S. EPA Methods: VOCs – 8260B, SVOCs – 8270C, PCBs – 8082, pesticides – 8081A, herbicides – 8151A, TAL metals – 6020/7000 series, lead – 7421, TPH – 8015 modified, dioxins and dibenzofurans – 8290
 - ^c dash indicates no sampling conducted
 - ^d a total of seven additional soil samples were collected at 9.60-RI1/2 and analyzed for total organic carbon (Walkley Black); grain-size distribution (ASTM D422); moisture content (ASTM D854 or D2216); dry density, specific gravity, and porosity (ASTM D854); or air permeability (API RP40)
 - ^e groundwater samples collected in July and December 2003
 - ^f a total of five additional soil samples were collected at 10.27-RI1 through 10.27-RI3 and analyzed for total organic carbon (Walkley Black); grain-size distribution (ASTM D422); moisture content (ASTM D854 or D2216); dry density, specific gravity, and porosity (ASTM D854); or air permeability (API RP40)
 - ^g a total of two additional soil samples were collected at 10.37-RI7 and analyzed for total organic carbon (Walkley Black); grain-size distribution (ASTM D422); moisture content (ASTM D854 or D2216); dry density, specific gravity, and porosity (ASTM D854); or air permeability (API RP40)
 - ^h at CAOC 10.38/10.39, the boring depths, sample depths, and sample analyses varied by location based on the depth to water and the estimated depth to the wastewater line at each location, and the COPCs and type of facilities located upflow of the sample location
 - ⁱ a total of seven additional soil samples were collected at 10.38-DS17-2, 10.38-DS11-TA, 10.38-TS4A, 10.38-DS3-1A, and 10.38-DS12-1 and analyzed for total organic carbon (Walkley Black); grain-size distribution (ASTM D422); moisture content (ASTM D854 or D2216); dry density, specific gravity, and porosity (ASTM D854); or air permeability (API RP40); selected geotechnical tests vary with location
 - ^j a total of three additional soil samples were collected at 10-RI4, 10-RI5, and 10-RI11 and analyzed for total organic carbon (Walkley Black); grain-size distribution (ASTM D422); moisture content (ASTM D854 or D2216); dry density, specific gravity, and porosity (ASTM D854); or air permeability (API RP40)

Acronyms/Abbreviations:

- API – American Petroleum Institute
- ASTM – American Society for Testing and Materials
- bgs – below ground surface
- CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
- COPC – chemical of potential concern
- OU – operable unit
- PCB – polychlorinated biphenyl
- RI – remedial investigation
- SVOC – semivolatile organic compound
- TAL – target analyte list
- TPH – total petroleum hydrocarbons
- U.S. EPA – United States Environmental Protection Agency
- VOC – volatile organic compound

Table 2-4
Sample Containers, Preservation, and Holding Times for
Organic and Inorganic Compounds in Nonaqueous Matrices at OU 7 CAOCs

Nonaqueous Matrices	U.S. EPA Method	Container	Preservation	Holding Time
VOCs (soil gas)	8260B	Tedlar™ bag (dual black layered)	none	72 hours Tedlar bag
TPH as gasoline	8015-M	En Core® or equivalent airtight sampler (U.S. EPA 5035)	Cool to 4 ° ± 2 °C	Freeze within 48 hours of collection, analyze within 7 days
TPH	8015-M	Amber glass jar/SS sleeve	Cool to 4 ° ± 2 °C	14/40 days*
SVOCs	8270C	Glass jar/SS sleeve	Cool to 4 ° ± 2 °C	14/40 days*
Pesticides	8081A	Amber glass jar/SS sleeve	Cool to 4 ° ± 2 °C	14/40 days*
Polychlorinated biphenyls	8082	Glass jar/SS sleeve	Cool to 4 ° ± 2 °C	14/40 days*
Dioxins/dibenzofurans	8290	Glass jar/SS sleeve	Cool to 4 ° ± 2 °C	30/45*
Herbicides	8151A	Glass jar/SS sleeve	Cool to 4 ° ± 2 °C	14/40*
Metals	6010/7000	Glass jar/SS sleeve	Cool to 4 ° ± 2 °C	6 months except 28 days for mercury
Lead	7421	Glass jar/SS sleeve	Cool to 4 ° ± 2 °C	6 months

Note:

* the first number indicates holding time to extraction; the second number indicates holding time to analysis

Acronyms/Abbreviations:

°C – degrees Celsius

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

OU – operable unit

SS – stainless steel

SVOC – semivolatile organic compound

TPH – total petroleum hydrocarbons

U.S. EPA – United States Environmental Protection Agency

VOC – volatile organic compound

Table 2-5
Sample Containers, Preservation, and Holding Times for
Organic and Inorganic Compounds in Groundwater at OU 7 CAOCs

Aqueous Matrices	U.S. EPA Method	Container	Preservation	Holding Time
VOCs	8260B	40-mL VOA vial	HCl to pH < 2; cool to 4 ° ± 2 °C	14 days
TPH as gasoline	8015-M	40-mL VOA vial	HCl to pH < 2; cool to 4 ° ± 2 °C	14 days
TPH as diesel, motor oil, fuel fingerprint	8015-M	1-L amber glass	Cool to 4 ° ± 2 °C	7/40 days*
SVOCs	8270C	1-L amber glass	Cool to 4 ° ± 2 °C	7/40 days*
Pesticides	8081A	1-L amber glass	Cool to 4 ° ± 2 °C	7/40 days*
Polychlorinated biphenyls	8082	1-L amber glass	Cool to 4 ° ± 2 °C	7/40 days*
Lead	7421	1-L plastic	HNO ₃ to pH < 2	6 months

Note:

- * the first number indicates holding time to extraction; the second number indicates holding time to analysis

Acronyms/Abbreviations:

°C – degrees Celsius

CAOC – Comprehensive Environmental Response, Compensation,
and Liability Act area of concern

HCl – hydrochloric acid

HNO₃ – nitric acid

L – liter

mL – milliliter

OU – operable unit

SVOC – semivolatile organic compound

TPH – total petroleum hydrocarbons

U.S. EPA – United States Environmental Protection Agency

VOA – volatile organic analysis

VOC – volatile organic compound

Table 2-6
Detection Limits for Soil From the OU 7 Remedial Investigation

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Residential Soil PRG
Total Petroleum Hydrocarbons					
Diesel	8015-M	646	72,666	µg/kg	— ^a
JP-4	8015-M	656	3,486	µg/kg	—
Motor oil	8015-M	3,510	209,677	µg/kg	—
Semivolatile Organic Compounds					
1,2,4-Trichlorobenzene	8270C	0.04	0.24	mg/kg	62
1,2-Dichlorobenzene	8270C	0.03	0.18	mg/kg	600
1,3-Dichlorobenzene	8270C	0.04	0.24	mg/kg	530
1,4-Dichlorobenzene	8270C	0.04	0.24	mg/kg	3.4
2,4,5-Trichlorophenol	8270C	0.03	0.18	mg/kg	6,100
2,4,6-Trichlorophenol	8270C	0.03	0.18	mg/kg	6.1
2,4-Dichlorophenol	8270C	0.03	0.18	mg/kg	180
2,4-Dimethylphenol	8270C	0.03	0.18	mg/kg	1,200
2,4-Dinitrophenol	8270C	0.02	0.12	mg/kg	120
2,4-Dinitrotoluene	8270C	0.03	0.18	mg/kg	120
2,6-Dinitrotoluene	8270C	0.03	0.18	mg/kg	61
2-Chloronaphthalene	8270C	0.03	0.18	mg/kg	4,900
2-Chlorophenol	8270C	0.04	0.24	mg/kg	63
2-Methylnaphthalene	8270C	0.03	0.18	mg/kg	—
2-Methylphenol	8270C	0.03	0.18	mg/kg	3,100
2-Nitroaniline	8270C	0.03	0.18	mg/kg	180
2-Nitrophenol	8270C	0.04	0.24	mg/kg	—
3,3'-Dichlorobenzidine	8270C	0.03	0.18	mg/kg	1.1
3-Nitroaniline	8270C	0.03	0.18	mg/kg	18
4,6-Dinitro-2-methylphenol	8270C	0.03	0.18	mg/kg	6.1
4-Bromophenyl phenyl ether	8270C	0.02	0.12	mg/kg	—
4-Chloro-3-methylphenol	8270C	0.02	0.12	mg/kg	—
4-Chloroaniline	8270C	0.03	0.18	mg/kg	240
4-Chlorophenyl phenyl ether	8270C	0.03	0.18	mg/kg	—
4-Methylphenol	8270C	0.03	0.18	mg/kg	310
4-Nitroaniline	8270C	0.02	0.12	mg/kg	23
4-Nitrophenol	8270C	0.03	0.18	mg/kg	—
Acenaphthene	8270C	0.03	0.18	mg/kg	3,700
Acenaphthylene	8270C	0.03	0.18	mg/kg	—
Anthracene	8270C	0.02	0.12	mg/kg	22,000
Benz(a)anthracene	8270C	0.02	0.4	mg/kg	0.62
Benzo(a)pyrene	8270C	0.02	0.4^b	mg/kg	0.062^b
Benzo(b)fluoranthene	8270C	0.02	0.4	mg/kg	0.62

(table continues)

Table 2-6 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Residential Soil PRG
Semivolatile Organic Compounds (continued)					
Benzo(g,h,i)perylene	8270C	0.02	0.4	mg/kg	—
Benzo(k)fluoranthene	8270C	0.02	0.4^b	mg/kg	0.38^{b,c}
Benzoic acid	8270C	0.02	0.12	mg/kg	100,000
Benzyl alcohol	8270C	0.04	0.24	mg/kg	18,000
bis(2-chloro-1-methylethyl)ether	8270C	0.04	0.21	mg/kg	2.9
bis(2-chloroethoxy)methane	8270C	0.03	0.18	mg/kg	—
bis(2-chloroethyl)ether	8270C	0.03	0.18	mg/kg	0.22
bis(2-chloroisopropyl)ether	8270C	0.04	0.24	mg/kg	—
bis(2-ethylhexyl)phthalate	8270C	0.03	0.18	mg/kg	35
Butyl benzyl phthalate	8270C	0.02	0.12	mg/kg	12,000
Chrysene	8270C	0.02	0.4	mg/kg	3.8 ^c
Dibenz(a,h)anthracene	8270C	0.02	0.12^b	mg/kg	0.062^b
Dibenzofuran	8270C	0.03	0.18	mg/kg	150
Diethyl phthalate	8270C	0.03	0.18	mg/kg	49,000
Dimethyl phthalate	8270C	0.03	0.18	mg/kg	100,000
di-N-butyl phthalate	8270C	0.04	0.24	mg/kg	6,100
di-N-octyl phthalate	8270C	0.02	0.12	mg/kg	2,400
Fluoranthene	8270C	0.03	0.6	mg/kg	2,300
Fluorene	8270C	0.03	0.18	mg/kg	2,700
Hexachlorobenzene	8270C	0.03	0.18	mg/kg	0.3
Hexachlorobutadiene	8270C	0.03	0.18	mg/kg	6.2
Hexachlorocyclopentadiene	8270C	0.04	0.24	mg/kg	370
Hexachloroethane	8270C	0.04	0.24	mg/kg	35
Indeno(1,2,3-cd)pyrene	8270C	0.02	0.4	mg/kg	0.62
Isophorone	8270C	0.03	0.18	mg/kg	510
Naphthalene	8270C	0.03	0.18	mg/kg	1.7 ^c
Nitrobenzene	8270C	0.04	0.24	mg/kg	20
n-Nitroso-di-n-propylamine	8270C	0.03	0.18^b	mg/kg	0.069^b
n-Nitrosodiphenylamine	8270C	0.02	0.12	mg/kg	99
Pentachlorophenol	8270C	0.03	0.18	mg/kg	3
Phenanthrene	8270C	0.02	0.12	mg/kg	—
Phenol	8270C	0.04	0.24	mg/kg	18,000
Pyrene	8270C	0.03	0.6	mg/kg	2,300
Dioxins and Dibenzofurans					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8290	0.039^b	4.9^b	pg/g	0.0039^{b,d}
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	8290	0.18^b	5^b	pg/g	0.0039^{b,d}
1,2,3,4,6,7,8-Heptachlorodibenzofuran	8290	0.019	2.3^b	pg/g	0.039^{b,d}
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	8290	0.025	2.5	pg/g	3.9 ^d
1,2,3,4,7,8,9-Heptachlorodibenzofuran	8290	0.02	1.9^b	pg/g	0.039^{b,d}

(table continues)

Table 2-6 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Residential Soil PRG
Dioxins and Dibenzofurans (continued)					
1,2,3,4,7,8-Hexachlorodibenzofuran	8290	0.025	2.6 ^b	pg/g	0.39 ^{b,d}
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	8290	0.042	2.1 ^b	pg/g	0.39 ^{b,d}
1,2,3,6,7,8-Hexachlorodibenzofuran	8290	0.017	1.8 ^b	pg/g	0.39 ^{b,d}
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	8290	0.042	1.3 ^b	pg/g	0.39 ^{b,d}
1,2,3,7,8,9-Hexachlorodibenzofuran	8290	0.022	1.2 ^b	pg/g	0.39 ^{b,d}
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	8290	0.039	2.1 ^b	pg/g	0.39 ^{b,d}
1,2,3,7,8-Pentachlorodibenzofuran	8290	0.022	0.83 ^b	pg/g	0.195 ^{b,d}
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	8290	0.032	2.3 ^b	pg/g	1.95 ^{b,d}
2,3,4,6,7,8-Hexachlorodibenzofuran	8290	0.019	2.5 ^b	pg/g	0.39 ^{b,d}
2,3,4,7,8-Pentachlorodibenzofuran	8290	0.022	1.9	pg/g	1.95 ^d
2,3,7,8-Tetrachlorodibenzofuran	8290	0.015	0.81 ^b	pg/g	0.39 ^{b,d}
2,3,7,8-Tetrachlorodibenzo-p-dioxin	8290	0.015	0.77	pg/g	3.9
Heptachlorodibenzofurans	8290	0.022	2.3 ^b	pg/g	0.039 ^{b,d}
Heptachlorodibenzo-p-dioxins	8290	0.025	2.5 ^b	pg/g	0.039 ^{b,d}
Hexachlorodibenzofurans	8290	0.028	2.6 ^b	pg/g	0.39 ^{b,d}
Hexachlorodibenzo-p-dioxins	8290	0.076	2.1 ^b	pg/g	0.39 ^{b,d}
Pentachlorodibenzofurans	8290	0.023	6.8 ^b	pg/g	1.95 ^{b,d}
Pentachlorodibenzo-p-dioxins	8290	0.037	2.3	pg/g	3.9 ^d
Tetrachlorodibenzofurans	8290	0.017	5.1 ^b	pg/g	0.39 ^{b,d}
Tetrachlorodibenzo-p-dioxins	8290	0.026	0.77	pg/g	3.9 ^d
Herbicides					
2,4,5-T	8151A	21.8	29	µg/kg	610,000
2,4,5-TP	8151A	13.7	18.2	µg/kg	490,000
2,4'-DB	8151A	262.3	348.3	µg/kg	490,000
Dalapon	8151A	115.4	153.3	µg/kg	1,800,000
Dicamba	8151A	11.8	15.7	µg/kg	1,800,000
Dichlorophenoxyacetic acid	8151A	84.7	112.5	µg/kg	690,000
Dichloroprop	8151A	54.4	72.2	µg/kg	—
Dinoseb	8151A	70.4	93.5	µg/kg	61,000
MCPA	8151A	14,220.4	18,885	µg/kg	31,000
MCPP	8151A	11,402.2	15,142.4	µg/kg	—
Pesticides					
4,4'-DDD	8081A	0.0003	0.0004	mg/kg	2.4
4,4'-DDE	8081A	0.0002	0.0003	mg/kg	1.7
4,4'-DDT	8081A	0.0002	0.0003	mg/kg	1.7
Aldrin	8081A	0.0001	0.0001	mg/kg	0.029
alpha-BHC	8081A	0.0002	0.0003	mg/kg	0.09
alpha-Chlordane	8081A	0.0002	0.0003	mg/kg	1.6 ^c
beta-BHC	8081A	0.0004	0.0005	mg/kg	0.32

(table continues)

Table 2-6 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Residential Soil PRG
Pesticides (continued)					
delta-BHC	8081A	0.0004	0.0005	mg/kg	0.44 ^f
Dieldrin	8081A	0.0002	0.0003	mg/kg	0.03
Endosulfan I	8081A	0.0002	0.0003	mg/kg	370 ^g
Endosulfan II	8081A	0.0013	0.0017	mg/kg	370 ^g
Endosulfan sulfate	8081A	0.0002	0.0003	mg/kg	—
Endrin	8081A	0.0003	0.0004	mg/kg	18
Endrin aldehyde	8081A	0.0002	0.0003	mg/kg	—
Endrin ketone	8081A	0.0001	0.0001	mg/kg	—
gamma-BHC (Lindane)	8081A	0.0003	0.0004	mg/kg	0.44
gamma-Chlordane	8081A	0.0002	0.0003	mg/kg	1.6 ^c
Heptachlor	8081A	0.0002	0.0003	mg/kg	0.11
Heptachlor epoxide	8081A	0.0002	0.0003	mg/kg	0.053
Methoxychlor	8081A	0.0002	0.0003	mg/kg	310
Toxaphene	8081A	0.019	0.025	mg/kg	0.44
Polychlorinated Biphenyls					
Aroclor 1016	8082	0.007	0.013.1	mg/kg	3.9
Aroclor 1221	8082	0.0055	0.024	mg/kg	0.22
Aroclor 1232	8082	0.004	0.019	mg/kg	0.22
Aroclor 1242	8082	0.0026	0.007	mg/kg	0.22
Aroclor 1248	8082	0.0014	0.046	mg/kg	0.22
Aroclor 1254	8082	0.0016	0.049	mg/kg	0.22
Aroclor 1260	8082	0.0036	0.008	mg/kg	0.22
Metals					
Aluminum	6010	8.084	107.357	mg/kg	76,000
Antimony	6010	0.178	1.878	mg/kg	31
Arsenic	6010	0.205^b	2.162^b	mg/kg	0.062^{b,d}
Barium	6010	0.019	0.2	mg/kg	5,400
Beryllium	6010	0.02	0.21	mg/kg	150
Cadmium	6010	0.028	0.295	mg/kg	37
Calcium	6010	2.748	31.842	mg/kg	—
Chromium	6010	0.081	0.854	mg/kg	210
Cobalt	6010	0.028	0.295	mg/kg	900
Copper	6010	0.198	2.089	mg/kg	3,100
Iron	6010	1.091	53.761	mg/kg	23,000
Lead	6010	0.161	1.698	mg/kg	150 ^c
Lead	7421	0.05	2.15	mg/kg	150 ^c
Magnesium	6010	1.67	17.62	mg/kg	—
Manganese	6010	0.024	0.285	mg/kg	1,800
Mercury	7471A	0.0104	0.0138	mg/kg	23

(table continues)

Table 2-6 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Residential Soil PRG
Metals (continued)					
Nickel	6010	0.068	0.717	mg/kg	1,600
Potassium	6010	1.32	13.92	mg/kg	—
Selenium	6010	0.158	1.667	mg/kg	390
Silver	6010	0.032	0.338	mg/kg	390
Sodium	6010	1.527	16.108	mg/kg	—
Thallium	6010	0.486	5.127	mg/kg	5.2
Vanadium	6010	0.04	0.42	mg/kg	550
Zinc	6010	0.384	4.051	mg/kg	23,000

Notes:

- ^a dash indicates no residential soil PRG for this analyte
- ^b values in **bold** indicate detection limits are greater than the PRG
- ^c California Environmental Protection Agency-modified PRG
- ^d PRG found by multiplying TEF for this analyte to PRG for 2,3,7,8-tetrachlorodibenzo-p-dioxin
- ^e PRG for chlordane
- ^f PRG for gamma-BHC (Lindane)
- ^g PRG for endosulfan

Acronyms/Abbreviations:

BHC – benzene hexachloride
 2,4'-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
 DDD – dichlorodiphenyldichloroethane
 DDE – dichlorodiphenyldichloroethene
 DDT – dichlorodiphenyltrichloroethane
 JP-4 – jet propellant grade 4
 µg/kg – micrograms per kilogram
 MCPA – 2-methyl-4-chlorophenoxyacetic acid
 MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
 mg/kg – milligrams per kilogram
 OU – operable unit
 pg/g – picograms per gram
 PRG – preliminary remediation goal
 2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
 2,4,5-TP – silvex
 TEF – toxicity equivalency factor
 U.S. EPA – United States Environmental Protection Agency

Table 2-7
Detection Limits for Groundwater From the OU 7 Remedial Investigation

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Federal MCL	California MCL
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	8260B	0.13	0.13	µg/L	— ^a	—
1,1,1-Trichloroethane	8260B	0.14	0.14	µg/L	200	200
1,1,2,2-Tetrachloroethane	8260B	0.27	0.27	µg/L	—	1
1,1,2-Trichloroethane	8260B	0.2	0.2	µg/L	5	5
1,1-Dichloroethane	8260B	0.19	0.19	µg/L	—	5
1,1-Dichloroethene	8260B	0.3	0.3	µg/L	7	6
1,1-Dichloropropene	8260B	0.2	0.2	µg/L	—	—
1,2,3-Trichlorobenzene	8260B	0.29	0.29	µg/L	—	—
1,2,3-Trichloropropane	8260B	0.39	0.39	µg/L	—	—
1,2,4-Trichlorobenzene	8260B	0.21	0.21	µg/L	70	5
1,2,4-Trimethylbenzene	8260B	0.19	0.19	µg/L	—	—
1,2-Dibromo-3-Chloropropane	8260B	0.76^b	0.76^b	µg/L	0.2^b	0.2^b
1,2-Dibromoethane	8260B	0.2^b	0.2^b	µg/L	0.05^b	0.05^b
1,2-Dichlorobenzene	8260B	0.17	0.17	µg/L	600	600
1,2-Dichloroethane	8260B	0.14	0.14	µg/L	5	0.5
1,2-Dichloropropane	8260B	0.17	0.17	µg/L	5	5
1,3,5-Trimethylbenzene	8260B	0.12	0.12	µg/L	—	—
1,3-Dichlorobenzene	8260B	0.11	0.11	µg/L	—	—
1,3-Dichloropropane	8260B	0.17	0.17	µg/L	—	—
1,4-Dichlorobenzene	8260B	0.19	0.19	µg/L	75	5
1-Chlorohexane	8260B	0.17	0.17	µg/L	—	—
2-Chlorotoluene	8260B	0.14	0.14	µg/L	—	—
4-Chlorotoluene	8260B	0.13	0.13	µg/L	—	—
Benzene	8260B	0.16	0.16	µg/L	5	1
Bromobenzene	8260B	0.16	0.16	µg/L	—	—
Bromochloromethane	8260B	0.15	0.15	µg/L	—	—
Bromodichloromethane	8260B	0.14	0.14	µg/L	—	—
Bromoform	8260B	0.14	0.14	µg/L	—	—
Bromomethane	8260B	0.24	0.24	µg/L	—	—
Carbon Tetrachloride	8260B	0.1	0.1	µg/L	5	0.5
Chlorobenzene	8260B	0.21	0.21	µg/L	100	70
Chlorodibromomethane	8260B	0.19	0.19	µg/L	—	—
Chloroethane	8260B	0.21	0.21	µg/L	—	—
Chloroform	8260B	0.16	0.16	µg/L	—	—
Chloromethane	8260B	0.31	0.31	µg/L	—	—
Cis-1,2-Dichloroethene	8260B	0.16	0.16	µg/L	70	6
Cis-1,3-Dichloropropene	8260B	0.15	0.15	µg/L	—	—
Dibromomethane	8260B	0.2	0.2	µg/L	—	—

(table continues)

Table 2-7 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Federal MCL	California MCL
Dichlorodifluoromethane	8260B	0.19	0.19	µg/L	—	—
Ethylbenzene	8260B	0.23	0.23	µg/L	700	300
Hexachlorobutadiene	8260B	0.19	0.19	µg/L	—	—
Isopropylbenzene	8260B	0.16	0.16	µg/L	—	—
m,p-Xylene	8260B	0.4	0.4	µg/L	—	—
Methylene Chloride	8260B	0.35	0.35	µg/L	5	5
Naphthalene	8260B	0.36	0.36	µg/L	—	—
N-Butylbenzene	8260B	0.15	0.15	µg/L	—	—
N-Propylbenzene	8260B	0.21	0.21	µg/L	—	—
o-Xylene	8260B	0.19	0.19	µg/L	—	—
p-Isopropyltoluene	8260B	0.12	0.12	µg/L	—	—
Sec-Butylbenzene	8260B	0.12	0.12	µg/L	—	—
Sec-Dichloropropane	8260B	0.22	0.22	µg/L	—	—
Styrene	8260B	0.25	0.25	µg/L	100	100
Tert-Butylbenzene	8260B	0.13	0.13	µg/L	—	—
Tetrachloroethene	8260B	0.15	0.15	µg/L	5	5
Toluene	8260B	0.17	0.17	µg/L	1000	150
Trans-1,2-Dichloroethene	8260B	0.19	0.19	µg/L	100	10
Trans-1,3-Dichloropropene	8260B	0.18	0.18	µg/L	—	—
Trichloroethene	8260B	0.16	0.16	µg/L	5	5
Trichlorofluoromethane	8260B	0.24	0.24	µg/L	—	150
Vinyl Chloride	8260B	0.23	0.23	µg/L	2	0.5
Total Petroleum Hydrocarbons						
Diesel	8015B	40.4	40.4	µg/L	—	—
JP-4	8015B	35	35	µg/L	—	—
Motor Oil	8015B	106	106	µg/L	—	—
Gasoline	8015-M	0.008	0.008	mg/L	—	—
Semivolatile Organic Compounds						
1,2,4-Trichlorobenzene	8270C	1.4	2.8	µg/L	70	5
1,2-Dichlorobenzene	8270C	1.4	2.8	µg/L	—	—
1,3-Dichlorobenzene	8270C	1.5	3	µg/L	—	—
1,4-Dichlorobenzene	8270C	1.4	2.8	µg/L	—	—
2,4,5-Trichlorophenol	8270C	0.8	1.6	µg/L	—	—
2,4,6-Trichlorophenol	8270C	0.9	1.8	µg/L	—	—
2,4-Dichlorophenol	8270C	0.9	1.8	µg/L	—	—
2,4-Dimethylphenol	8270C	1	2	µg/L	—	—
2,4-Dinitrophenol	8270C	0.3	0.6	µg/L	—	—
2,4-Dinitrotoluene	8270C	0.8	1.6	µg/L	—	—
2,6-Dinitrotoluene	8270C	0.7	1.4	µg/L	—	—

(table continues)

Table 2-7 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Federal MCL	California MCL
2-Chloronaphthalene	8270C	1.2	2.4	µg/L	—	—
2-Chlorophenol	8270C	0.9	1.8	µg/L	—	—
2-Methylnaphthalene	8270C	1	2	µg/L	—	—
2-Methylphenol	8270C	0.9	1.8	µg/L	—	—
2-Nitroaniline	8270C	0.6	1.2	µg/L	—	—
2-Nitrophenol	8270C	0.9	1.8	µg/L	—	—
3,3'-Dichlorobenzidine	8270C	1.4	2.8	µg/L	—	—
3-Nitroaniline	8270C	0.9	1.8	µg/L	—	—
4,6-Dinitro-2-Methylphenol	8270C	0.6	1.2	µg/L	—	—
4-Bromophenyl Phenyl Ether	8270C	1.1	2.2	µg/L	—	—
4-Chloro-3-Methylphenol	8270C	1	2	µg/L	—	—
4-Chloroaniline	8270C	0.6	1.2	µg/L	—	—
4-Chlorophenyl Phenyl Ether	8270C	1.1	2.2	µg/L	—	—
4-Methylphenol	8270C	0.8	1.6	µg/L	—	—
4-Nitroaniline	8270C	0.7	1.4	µg/L	—	—
4-Nitrophenol	8270C	0.2	0.4	µg/L	—	—
Acenaphthene	8270C	0.9	1.8	µg/L	—	—
Acenaphthylene	8270C	0.9	1.8	µg/L	—	—
Anthracene	8270C	1.1	2.2	µg/L	—	—
Benz(a)Anthracene	8270C	0.9	1.8	µg/L	—	—
Benzo(a)Pyrene	8270C	0.8^b	1.6^b	µg/L	0.2^b	0.2^b
Benzo(b)Fluoranthene	8270C	1	2	µg/L	—	—
Benzo(g,h,i)Perylene	8270C	0.7	1.4	µg/L	—	—
Benzo(k)Fluoranthene	8270C	1	2	µg/L	—	—
Benzoic Acid	8270C	0.5	1	µg/L	—	—
Benzyl Alcohol	8270C	1	2	µg/L	—	—
Bis(2-Chloro-1-Methylethyl)Ether	8270C	0.9	0.9	µg/L	—	—
Bis(2-Chloroethoxy)Methane	8270C	0.8	1.6	µg/L	—	—
Bis(2-Chloroethyl)Ether	8270C	0.9	1.8	µg/L	—	—
Bis(2-Chloroisopropyl)Ether	8270C	0.9	1.8	µg/L	—	—
Bis(2-Ethylhexyl)Phthalate	8270C	0.8	1.6	µg/L	6	4
Butyl Benzyl Phthalate	8270C	0.9	1.8	µg/L	—	—
Chrysene	8270C	0.9	1.8	µg/L	—	—
Dibenz(a,h)Anthracene	8270C	0.8	1.6	µg/L	—	—
Dibenzofuran	8270C	1.2	2.4	µg/L	—	—
Diethyl Phthalate	8270C	1	2	µg/L	—	—
Dimethyl Phthalate	8270C	0.9	1.8	µg/L	—	—
Di-n-Butyl Phthalate	8270C	1	2	µg/L	—	—
Di-n-Octyl Phthalate	8270C	0.5	1	µg/L	—	—

(table continues)

Table 2-7 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Federal MCL	California MCL
Fluoranthene	8270C	1	2	µg/L	—	—
Fluorene	8270C	1.1	2.2	µg/L	—	—
Hexachlorobenzene	8270C	1.4^b	2.8^b	µg/L	1^b	1^b
Hexachlorobutadiene	8270C	1.9	3.8	µg/L	—	—
Hexachlorocyclopentadiene	8270C	0.8	1.6	µg/L	50	50
Hexachloroethane	8270C	1.4	2.8	µg/L	—	—
Indeno(1,2,3-cd)Pyrene	8270C	0.6	1.2	µg/L	—	—
Isophorone	8270C	0.9	1.8	µg/L	—	—
Naphthalene	8270C	1.2	2.4	µg/L	—	—
Nitrobenzene	8270C	1.1	2.2	µg/L	—	—
N-Nitroso-Di-N-Propylamine	8270C	0.8	1.6	µg/L	—	—
N-Nitrosodiphenylamine	8270C	0.6	1.2	µg/L	—	—
Pentachlorophenol	8270C	0.7	1.4^b	µg/L	1^b	1^b
Phenanthrene	8270C	1	2	µg/L	—	—
Phenol	8270C	0.5	1	µg/L	—	—
Pyrene	8270C	1	2	µg/L	—	—
Pesticides						
4,4'-DDD	8081A	0.003	0.003	µg/L	—	—
4,4'-DDE	8081A	0.004	0.004	µg/L	—	—
4,4'-DDT	8081A	0.007	0.007	µg/L	—	—
Aldrin	8081A	0.009	0.009	µg/L	—	—
Alpha-BHC	8081A	0.005	0.005	µg/L	—	—
Alpha-Chlordane	8081A	0.007	0.007	µg/L	2 ^c	0.1 ^c
Beta-BHC	8081A	0.008	0.008	µg/L	—	—
Delta-BHC	8081A	0.005	0.005	µg/L	—	—
Dieldrin	8081A	0.005	0.005	µg/L	—	—
Endosulfan I	8081A	0.005	0.005	µg/L	—	—
Endosulfan II	8081A	0.004	0.004	µg/L	—	—
Endosulfan Sulfate	8081A	0.005	0.005	µg/L	—	—
Endrin	8081A	0.007	0.007	µg/L	2	2
Endrin Aldehyde	8081A	0.009	0.009	µg/L	—	—
Endrin Ketone	8081A	0.006	0.006	µg/L	—	—
Gamma-BHC (Lindane)	8081A	0.005	0.005	µg/L	0.2	0.2
Gamma-Chlordane	8081A	0.006	0.006	µg/L	2 ^c	0.1 ^c
Heptachlor	8081A	0.008	0.008	µg/L	0.4	0.01
Heptachlor Epoxide	8081A	0.007	0.007	µg/L	0.2	0.01
Methoxychlor	8081A	0.008	0.008	µg/L	40	30
Toxaphene	8081A	0.38	0.38	µg/L	3	3

(table continues)

Table 2-7 (continued)

Analyte	U.S. EPA Method	Minimum Detection Limit	Maximum Detection Limit	Units	Federal MCL	California MCL
Polychlorinated Biphenyls						
Aroclor 1016	8082	0.12	0.12	µg/L	0.5 ^d	0.5 ^d
Aroclor 1221	8082	0.08	0.08	µg/L	0.5 ^d	0.5 ^d
Aroclor 1232	8082	0.12	0.12	µg/L	0.5 ^d	0.5 ^d
Aroclor 1242	8082	0.12	0.12	µg/L	0.5 ^d	0.5 ^d
Aroclor 1248	8082	0.09	0.09	µg/L	0.5 ^d	0.5 ^d
Aroclor 1254	8082	0.2	0.2	µg/L	0.5 ^d	0.5 ^d
Aroclor 1260	8082	0.09	0.09	µg/L	0.5 ^d	0.5 ^d
Metals						
Lead	7421	0.33	0.33	µg/L	15 ^e	15 ^e

Notes:

- ^a dash indicates no MCL for this analyte
- ^b values in **bold** indicate detection limits are greater than the federal MCL and/or California MCL
- ^c PRG for chlordane
- ^d PRG for polychlorinated biphenyls
- ^e action level for lead

Acronyms/Abbreviations:

BHC – benzene hexachloride
 DDD – dichlorodiphenyldichloroethane
 DDE – dichlorodiphenyldichloroethene
 DDT –dichlorodiphenyltrichloroethane
 JP-4 – jet propellant grade 4
 µg/L – micrograms per liter
 MCL – maximum contaminant level
 OU – operable unit
 PRG – preliminary remediation goal
 U.S. EPA –United States Environmental Protection Agency

Section 3

PHYSICAL CHARACTERISTICS OF MCLB BARSTOW

This section describes physical characteristics of MCLB Barstow as a whole. It includes information about geology, hydrogeology, meteorology, lithology, soils, and land use. CAOC-specific physical characteristics are discussed in Attachments A through G.

3.1 ENVIRONMENTAL SETTING

The following subsections provide general information on the environmental setting of OU 7 and MCLB Barstow.

3.1.1 Soils

This section presents a summary of the soil survey conducted in the area of MCLB Barstow (USDA 1986). For CAOC-specific discussions of soil types, see Section 3.2 of the attachments. With the exception of CAOC 10.37 and 10.38/10.39, most of the CAOCs are partially or completely unpaved, and there is presently minimal vegetation over the surface soil. Soil units that predominate at OU 7 include the Cajon-Manet and Yermo-Kimberlina-Typic Haplargids (Figure 3-1).

The Cajon-Manet unit consists of very deep, nearly level to strongly sloping, somewhat excessively drained and well-drained soils on recent alluvial fans. Included in this unit are Cajon soil, Manet soil, and Arizo soil.

Cajon soil is somewhat excessively drained. Slopes range from 0 to 15 percent. Typically, the profile is sand and loamy sand throughout. There are strata of gravelly sand in the lower part of the profile. In some areas, the soil is gravelly sand throughout. Manet soil is well drained. Slopes range from 0 to 9 percent. Typically, the profile is sand and loamy sand and strata of fine loamy sand. Arizo soil is excessively drained and located on the upper parts of alluvial fans. Arizo soil is very gravelly and consists of as much as 60 percent coarse fragments.

The Yermo-Kimberlina-Typic Haplargids unit is present on alluvial fans that are deeply dissected and eroded terraces. The fans have broad, smooth, and commonly undulating slopes, and on the terraces form hills that have steep, convex slopes.

Yermo soil is on alluvial fans and hills. Slopes range from 5 to 50 percent. Typically, the surface layer is cobbly sandy loam. The underlying material is calcareous gravelly sandy loam and very gravelly sandy loam. The underlying material is as much as 60 percent gravel and 15 percent cobbles. Kimberlina soil is also on alluvial fans. Slopes range from 2 to 9 percent. Typically, the soil is calcareous sandy loam that is 0 to 25 percent pebbles and cobbles. Typic Haplargid is present on hills. Slopes range from 8 to 15 percent, and typically 70 to 90 percent of the surface is covered by a desert pavement of varnished gravel and cobbles. The surface layer ranges from gravelly sand to gravelly sandy loam, and the subsoil ranges from sandy loam to very gravelly sandy clay loam. The substratum ranges from gravelly sand to very gravelly loamy sand (USDA 1986).

3.1.2 Geology and Hydrogeology

The following sections summarize the regional and local geology and hydrology of MCLB Barstow as well as groundwater remediation systems present at the base.

3.1.2.1 REGIONAL GEOLOGY

MCLB Barstow is located within the Mojave Desert Geomorphic Province. This province is wedge-shaped and bounded by the Garlock Fault on the north and the San Andreas Fault on the southwest. The approximate eastern boundary is the Bristol-Granite Mountains Fault zone in the eastern Mojave Desert. At this diffuse boundary, the Mojave Desert merges with the Basin and Range Geomorphic Province. The Mojave Desert province is characterized by a series of low-lying, northwest-trending mountain ranges with intermountain basins and local playas (Dokka and Travis 1990).

3.1.2.2 REGIONAL HYDROGEOLOGY

MCLB Barstow is located within the Mojave River drainage basin. This basin covers about 3,700 square miles in the south-central Mojave Desert (Hyatt 1934). The Mojave River originates as a series of complementary drainages along the north front of the San Bernardino Mountains. The river extends north from the mountain front, turning east as it passes through the city of Barstow and MCLB Barstow, and terminates at Soda Lake about 55 miles east of Nebo Main Base. Because the river is fed primarily by distant mountain-front drainages and due to regional climate patterns, the riverbed is generally dry (ephemeral), and flow in the Barstow area is limited to periods of heavy rain (storm runoff). Approximately 98 percent of stored water in the Mojave River basin originated in the San Bernardino Mountains and is distributed by the Mojave River (Hardt 1971).

United States Geological Survey (USGS) identified two aquifers in the Mojave River drainage basin: the floodplain aquifer along the Mojave River channel (also described as the “shallow alluvial aquifer” and the “Mojave River aquifer”) and the regional aquifer that underlies and surrounds the floodplain aquifer (Stamos et al. 2001). The floodplain aquifer consists of recent Mojave River deposits (sand, silt, and gravel) that are Holocene to late Pleistocene age. This aquifer is generally 100 to 200 feet thick and located within 1 mile of the Mojave River (Stamos et al. 2001). The regional aquifer consists of an assemblage of undifferentiated alluvium (alluvial fan, braided stream, and playa or lacustrine deposits), ranging from Holocene to late Pliocene in age, and ancestral Mojave River deposits consisting of granitic sand, silt, and gravel that are Pleistocene to Pliocene in age (Stamos et al. 2001). The regional aquifer is more than 2,000 feet thick in some areas. The permeability of the regional aquifer deposits is lower than the floodplain aquifer sediments because of poor sorting on alluvial fans and widespread accumulation of secondary clay and calcium carbonate cement (Stamos et al. 2001). The hydraulic conductivities of the floodplain and regional aquifers are approximately 150 feet per day and 1.5 feet per day, respectively (Hughes and Robeson 1973). Regional groundwater flow in the Mojave River drainage basin is generally to the east to northeast (Stamos et al. 2001).

Section 3 Physical Characteristics of MCLB Barstow

3.1.2.3 LOCAL GEOLOGY

MCLB Barstow is located in the west-northwest-trending Barstow Basin, roughly bounded by the Blackwater Fault to the northeast and the Lenwood Fault to the southwest (Figures 3-2, 3-3, and 3-4). Low ranges form the northern and southern boundaries of the basin. Basement rocks are at a depth of about 3,500 feet bgs along the mountain front (near Daggett Ridge), 6 miles southeast of Nebo Main Base (BNI 1998a).

The northwest trending Camp Rock-Harper Lake Fault zone, which cuts through the Nebo Main Base area, extends from about 30 miles southeast of Nebo Main Base to just east of Harper Lake, about 15 miles to the northwest. The fault is defined by five northwest-trending, right-lateral, strike-slip strands in the area of Nebo Main Base (USGS 1997).

Exposed bedrock consists primarily of Tertiary sedimentary and volcanic rocks. The basin is filled by a sequence of late Tertiary to Quaternary alluvial deposits. The surface is mantled by windblown deposits and young alluvial deposits derived from the Mojave River and/or shed from adjacent highlands. The southern portion of Nebo Main Base is underlain by coarse alluvial-fan debris containing abundant gravel and cobbles (Dibblee 1970).

3.1.2.4 GROUNDWATER REMEDIATION SYSTEMS

The vadose zone and contaminated groundwater underlying MCLB Barstow are designated as OUs 1 (Yermo Annex) and 2 (Nebo Main Base). OU 1 at Yermo Annex was identified as one commingled VOC plume emanating from several sources (CAOCs 16, 15/17, 23, 26 [Building 533 Waste Disposal Area], and 35 [Class III Landfill]). OU 2 at Nebo Main Base is divided into two discrete groundwater plumes: the North VOC Groundwater Plume, with contaminants believed to have come from Warehouse 2 and former Building 50, and the South VOC Groundwater Plume, with contaminants from the Original Trash Landfill (CAOC 6). A soil vapor extraction (SVE)/air sparging (AS) treatability/pilot test(s) was conducted in June through July 2003 in the suspected source area near the upgradient (western) end of the North VOC Groundwater Plume (BEI 2004).

Five groundwater remediation systems, two groundwater extraction and treatment systems (GETS), and three SVE/AS *in situ* remedial systems are presently in place at MCLB Barstow. These systems are designed to either reduce VOC contaminant mass in both the vadose and saturated zone or provide hydraulic containment and treatment for dissolved VOC contaminants in groundwater. The treatment systems are located at OU 1 Yermo Annex (two SVE/AS systems and one GETS) and OU 2 Nebo Main Base (pilot-scale SVE/AS and one GETS) (FWEC 2003).

OU 1 Yermo Annex Remediation System Status

The SVE/AS system for CAOC 16, Marine Multi-Commodity Maintenance Center, is in service (June 1999 through the present) and has been effective in removing VOCs from the vadose zone and groundwater.

Section 3 Physical Characteristics of MCLB Barstow

The SVE/AS system for CAOC 26, Building 533 Waste Disposal Area, is presently on standby (FWEC 2003). This system was in operation from December 1996 until the end of December 1998, when asymptotic conditions for contaminants were reached, indicating that the technology was successful in reducing contaminant mass in the vadose and saturated zones.

The GETS was shut down in December 2000 when methyl tert-butyl ether (MTBE) was reported in a number of monitoring wells in the southeastern portion of the Yermo Annex plume. The system was restarted in May 2002 (FWEC 2003).

OU 2 Nebo Main Base

The pilot-scale system for CAOC 6, Original Trash Landfill, South VOC Groundwater Plume, is on-going. Results of the Phase 2 SVE/AS pilot test indicate that SVE/AS is a feasible technology for remediating VOC-impacted groundwater at CAOC 6. Expansion of this system is currently planned.

The GETS was designed to provide hydraulic containment and treat groundwater extracted from the OU 2 North VOC Groundwater Plume. A pilot test was conducted to evaluate VOC mass removal rates and plume behavior. Results indicated that 10 times more VOC mass was removed from groundwater than was estimated prior to the test. The GETS is presently on standby and could be started if VOCs exceed MCLs at selected monitoring wells (FWEC 2003).

3.1.2.5 LOCAL HYDROGEOLOGY

The Mojave River drainage basin consists of a series of subbasins separated by relatively impermeable bedrock. MCLB Barstow is within the Lower Mojave subunit (DWR 1967). The Lower Mojave subunit is further subdivided into several subbasins; Nebo Main Base and Yermo Annex are within the Barstow and Yermo subbasins, respectively.

Based on review of data in the USGS Mojave River basin study (Stamos et al. 2001) and the OUs 1 and 2 RI/FS (JEG 1995), shallow groundwater in the northern portion of Nebo Main Base (generally north of Joseph Boll Avenue) and all of Yermo Annex is contained in the Mojave River floodplain aquifer. Shallow groundwater in the southern portion of Nebo Main Base (generally south of Joseph Boll Avenue) is contained in the lower-permeability regional aquifer. This interpretation at Nebo Main Base is consistent with the change in groundwater gradient and flow direction in the area along Joseph Boll Avenue (FWEC 2003): a steeper gradient and northeast flow direction to the south and a flatter gradient and east flow direction to the north. At Nebo Main Base, the floodplain aquifer is about 3/4-mile wide (Stamos et al. 2001) and appears to be underlain by the regional aquifer at about 200 to 225 feet bgs, based on deep boring data (JEG 1995). The base of the regional aquifer (bedrock) was not encountered at Nebo Main Base in the deep borings, which ranged in depth from 344 to 605 feet bgs (JEG 1995).

At Yermo Annex, the floodplain aquifer is over 3 miles wide and is underlain by the regional aquifer generally at about 200 feet bgs (Stamos et al. 2001). The base of the regional aquifer (bedrock) was encountered beneath Yermo Annex at depths ranging from approximately 225 to 630 feet bgs, based on deep boring data (JEG 1995).

Section 3 Physical Characteristics of MCLB Barstow

However, bedrock as shallow as 96 feet bgs was reported near the western entrance of Yermo Annex (JEG 1995), indicating that localized shallow bedrock occurs in the area.

The hydraulic conductivity of the shallow aquifer at Yermo Annex averages 113 feet per day (JEG 1995), which is generally consistent with the regional hydraulic conductivity for the floodplain aquifer (Section 3.1.2.2). The hydraulic conductivity of the shallow aquifer at Nebo Main Base ranges from 255 feet per day in the vicinity of the North VOC Groundwater Plume, to 28 feet per day in the vicinity of the South VOC Groundwater Plume (CAOC 6) (JEG 1995). This variation in hydraulic conductivities is generally consistent with the regional variability between the floodplain and regional aquifers (Section 3.1.2.2).

At Nebo Main Base, monitoring well gauging data collected for the year 2002 indicate that the depth to groundwater was from about 10 feet bgs in the north near the Mojave River to about 210 feet bgs at the southern boundary of the base (FWEC 2003). Groundwater levels in 2002 declined from 0.5 foot to over 3.7 feet across Nebo Main Base, with the largest declines east of the Camp Rock-Harper Lake Fault zone and smaller declines of about 0.5 foot to 1.0 feet west of the fault zone (FWEC 2003). Historical groundwater flow patterns have remained fairly consistent. The GETS in the northern part of Nebo Main Base is on standby, and therefore has not impacted recent groundwater depths or flow patterns. Groundwater elevation contours and well locations for Nebo Main Base are presented on Figure 3-5.

The observed groundwater flow patterns indicate a significant influence from the Camp Rock-Harper Lake Fault zone. Five northwest-trending strands in the area of Nebo Main Base define the northwest-trending Camp Rock-Harper Lake Fault zone. One of these strands, shown on Figure 3-5, forms a groundwater barrier that impedes groundwater flow across the Nebo Main Base area (Stamos et al. 2001). The depth to groundwater east of this fault-zone strand was about 25 feet deeper than immediately west of the strand, based on 2002 groundwater elevation maps (FWEC 2003). East of this fault-zone strand, the groundwater flow was generally to the southeast with a fairly consistent hydraulic gradient averaging 0.0031 foot per foot during 2002 (FWEC 2003). West of this fault-zone strand, groundwater flow was generally east-northeast with a hydraulic gradient from 0.002 foot per foot (north part of Nebo Main Base) to 0.021 foot per foot (south part of Nebo Main Base) during 2002 (FWEC 2003). The other fault-zone strands do not appear to impact groundwater flow.

At Yermo Annex, data collected for the year 2002 indicate that the depth to groundwater ranged from about 153 to 174 feet bgs (FWEC 2003). Groundwater elevation data from the Yermo Annex wells indicated the groundwater elevations continued to decline. The total decline for 2002 ranged from 0.5 foot to 2.5 feet, with an average of approximately 1.5 feet (FWEC 2003). The groundwater gradient with the GETS off varied from approximately 0.00016 to 0.0033 foot per foot during 2002, with a basewide gradient of 0.00062 foot per foot (FWEC 2003). A steeper gradient of 0.00033 to 0.013 foot per foot was reported with the GETS operating (FWEC 2003). The general groundwater flow direction in the northern portion of Yermo Annex was from west to east and in the

Section 3 Physical Characteristics of MCLB Barstow

southern portion was from west/southwest to east/northeast (FWEC 2003). Groundwater elevation contours and well locations for Yermo Annex are presented on Figure 3-6.

The GETS in the northern portion of Yermo Annex was shut down in December 2000 and restarted in May 2002. Based on interpreted groundwater flow patterns, the operation of the CAOCs 16 and 26 SVE/AS remediation systems has minimal effect on overall groundwater flow direction in the Yermo Annex area, although localized hydraulic containment of VOC plumes was reported (FWEC 2003).

3.1.3 Climate

The climate in the Barstow area is typical of deserts in the southwestern United States. During the summer months, daytime high temperatures are generally from 100 to 110 degrees Fahrenheit (°F), with occasional highs greater than 125 °F. Winter daytime high temperatures generally range from the high 40s to the mid-60s, and winter lows below freezing are not uncommon. The prevailing wind direction throughout the entire year is from the west, with average wind speeds of approximately 10 to 15 miles per hour. The mean annual rainfall is approximately 4 inches with a 24-hour maximum precipitation that rarely exceeds 3 inches (NOAA 1993). The potential evaporation is probably greater than 70 inches per year, which far exceeds the average precipitation (DWR 1967). Infiltration is usually estimated to be approximately 10 percent of the annual rainfall (Walton 1989). For MCLB Barstow, this would result in an annual recharge rate of only 0.4 inch. Based on other site-specific factors, including the high evapotranspiration rates, the net infiltration rate from precipitation at MCLB Barstow may be even less than the estimated 0.4 inch.

3.1.4 Topography

Regional topography near Barstow is dominated by broad, gently sloping surfaces formed by coalescing alluvial fans and the isolated fronts and peaks of the region's fault block mountains (JEG 1996). Both Nebo Main Base and Yermo Annex were constructed near the Mojave River, where topography is relatively flat. The topographic surface at Nebo Main Base and the rifle range slopes north-northeast to the Mojave River, and the surface at Yermo Annex gently slopes south-southeast to the Mojave River. Nebo Main Base lies between about 2,000 and 2,300 feet above mean sea level (MSL). The rifle range was constructed south of Nebo Main Base where the topographic surface begins to rise to eventually meet Daggett Ridge. The rifle range lies between about 2,300 and 2,400 feet above MSL. Yermo Annex lies between about 1,950 and 1,985 feet above MSL. Figures 3-7 and 3-8 show the topographic contours at Nebo Main Base and Yermo Annex, respectively.

3.1.5 Current Land Use

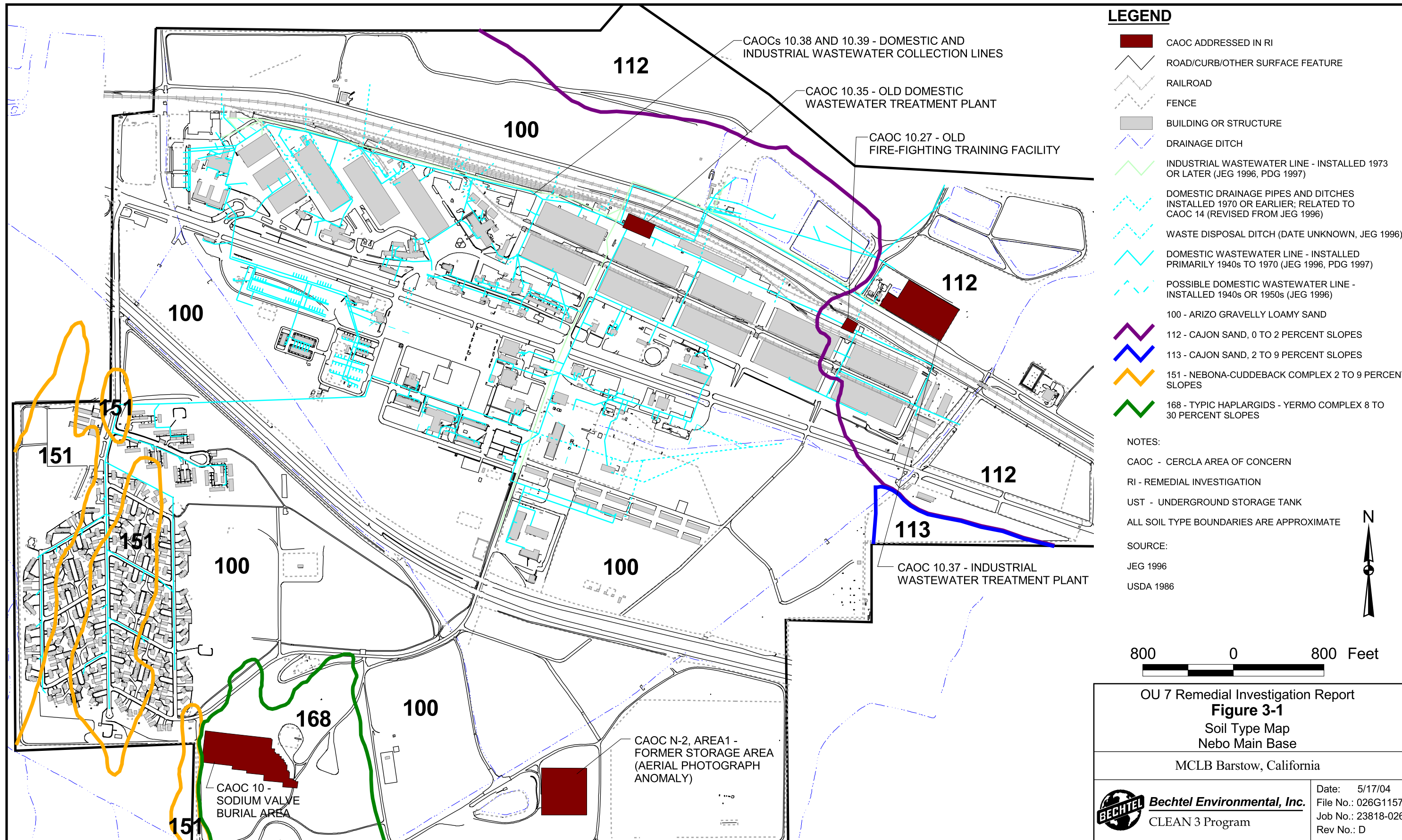
The current land use at MCLB Barstow is industrial. MCLB Barstow provides logistical support to DoD and other military organizations by receiving, maintaining, repairing, and storing military supplies and equipment, and trains Marines in the logistical skills of warehousing. As a result of these functions, the base conducts industrial operations at

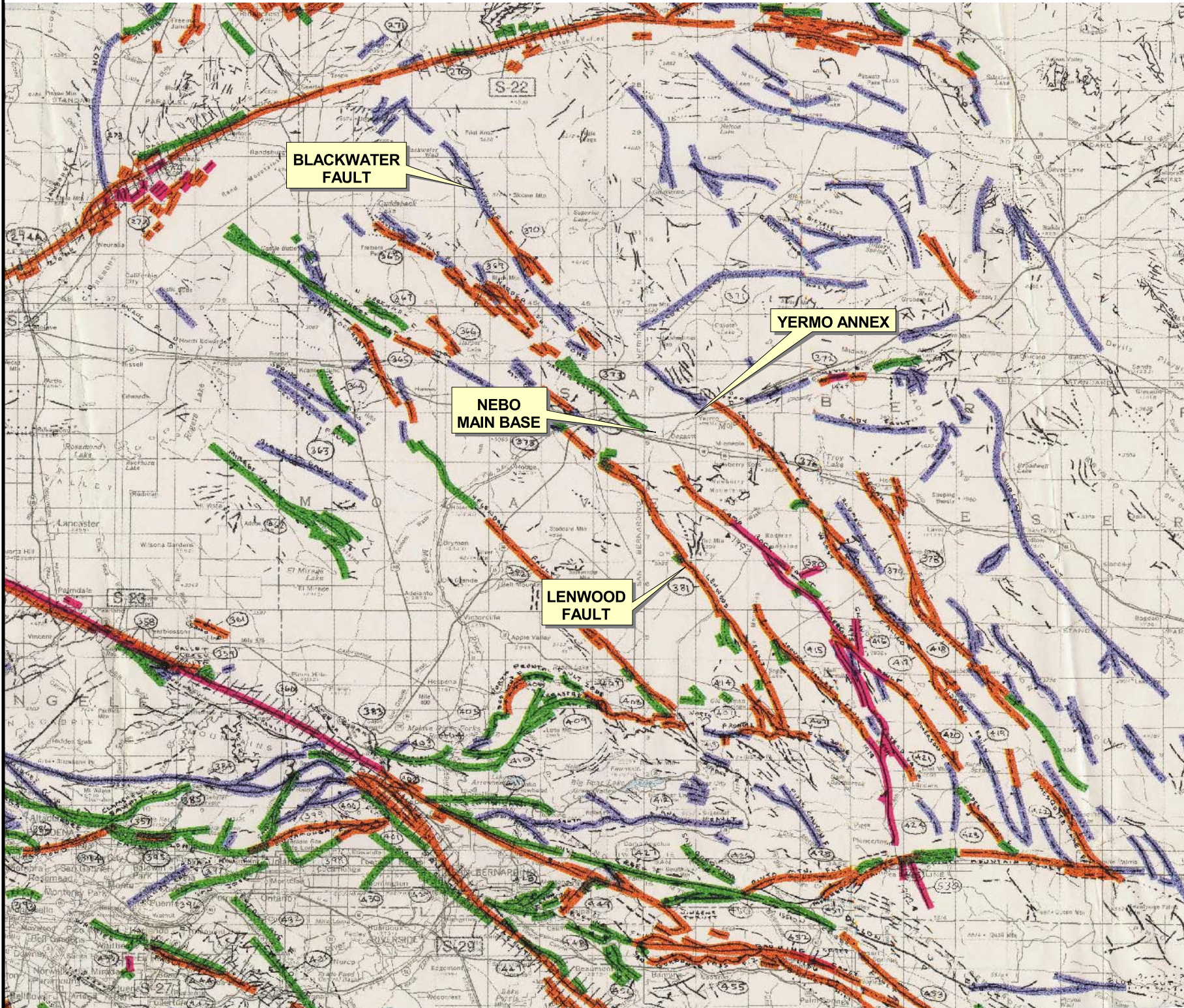
Section 3 Physical Characteristics of MCLB Barstow

numerous locations throughout Yermo Annex. Nebo Main Base is primarily used for warehousing and administrative activities, although it includes several housing areas where on-base personnel and families reside. A rifle range is also located in the southern portion of Nebo Main Base, south of Interstate Highway 40. Since the mid-1950s, it has been used for small arms practice (BNI 1998a). Nebo Main Base (including the rifle range) is approximately 4,006 acres in area, and Yermo Annex is approximately 1,680 acres in area. Land use is shown on Figure 3-9.

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LEGEND

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		200			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.	
	Pleistocene	10,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of late Pleistocene or older Quaternary age.	
				Mesozoic Foothills fault system along which short segments of late Cenozoic faulting has taken place.			
		700,000			Undivided Quaternary faults – most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.		
Early Quaternary		1,600,000					
Pre-Quaternary						Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.
			4.5 billion (Age of earth)				

SOURCE:
JENNINGS, 1992 (CALIFORNIA DIVISION OF MINES AND GEOLOGY OPEN-FILE REPORT 92-03)

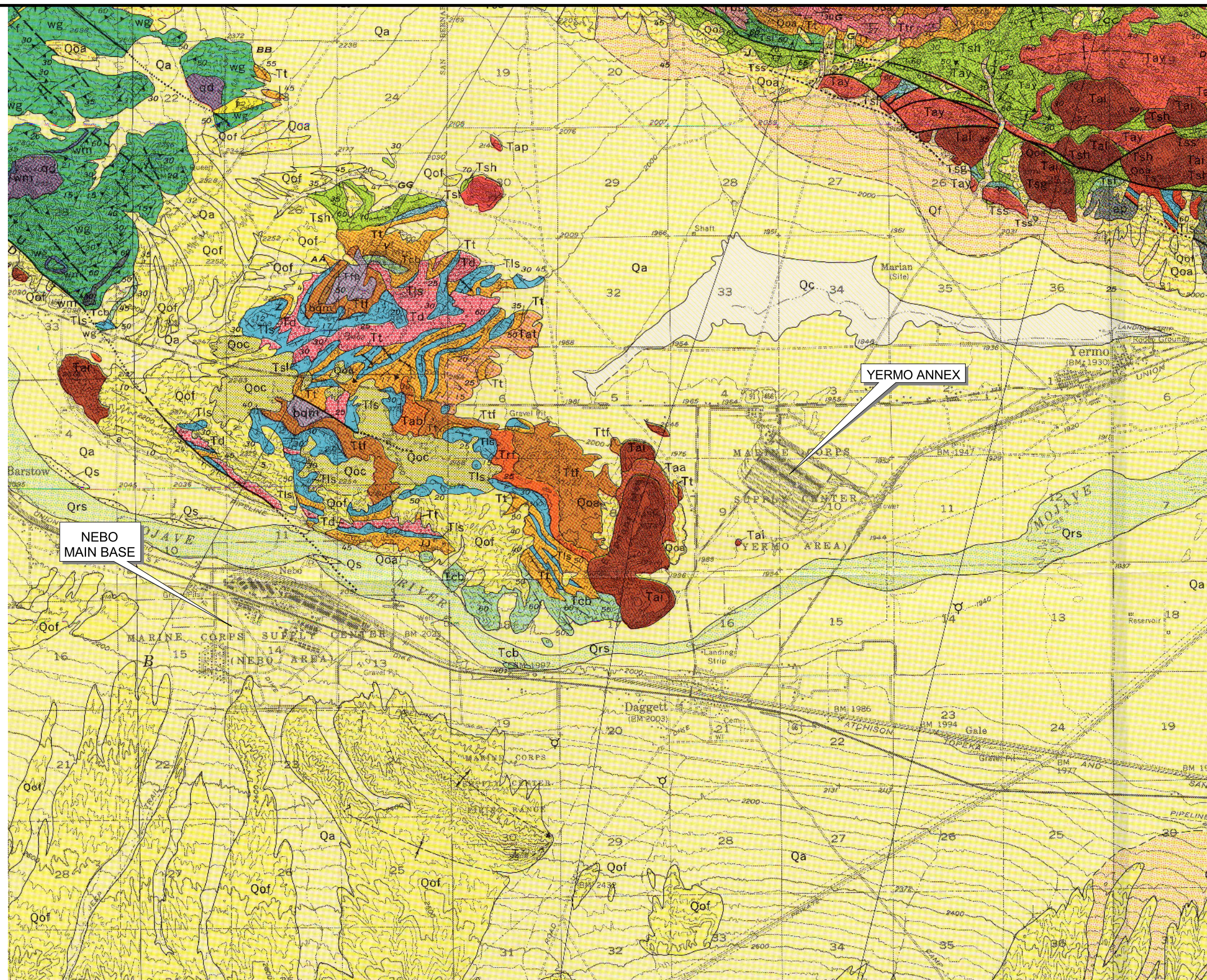


OU 7 Remedial Investigation Report
Figure 3-2
Regional Fault Map
MCLB Barstow, California



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Job No.: 23818-026
Rev No.: C

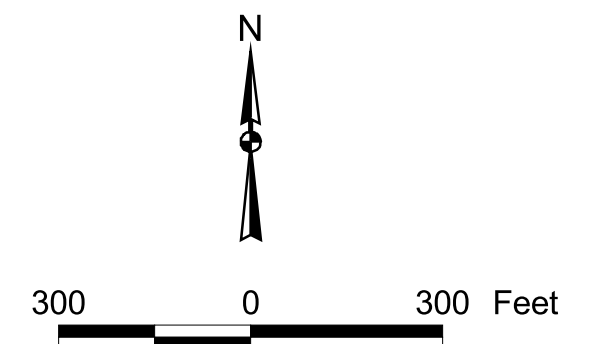


SOURCE:

DIBBLEE 1970 (US GEOLOGICAL SURVEY, MISCELLANEOUS GEOLOGIC INVESTIGATIONS, MAP I-592)

NOTE:

FOR GEOLOGY LEGEND SEE FIGURE 3-4



OU 7 Remedial Investigation Report

Figure 3-3

Local Geology

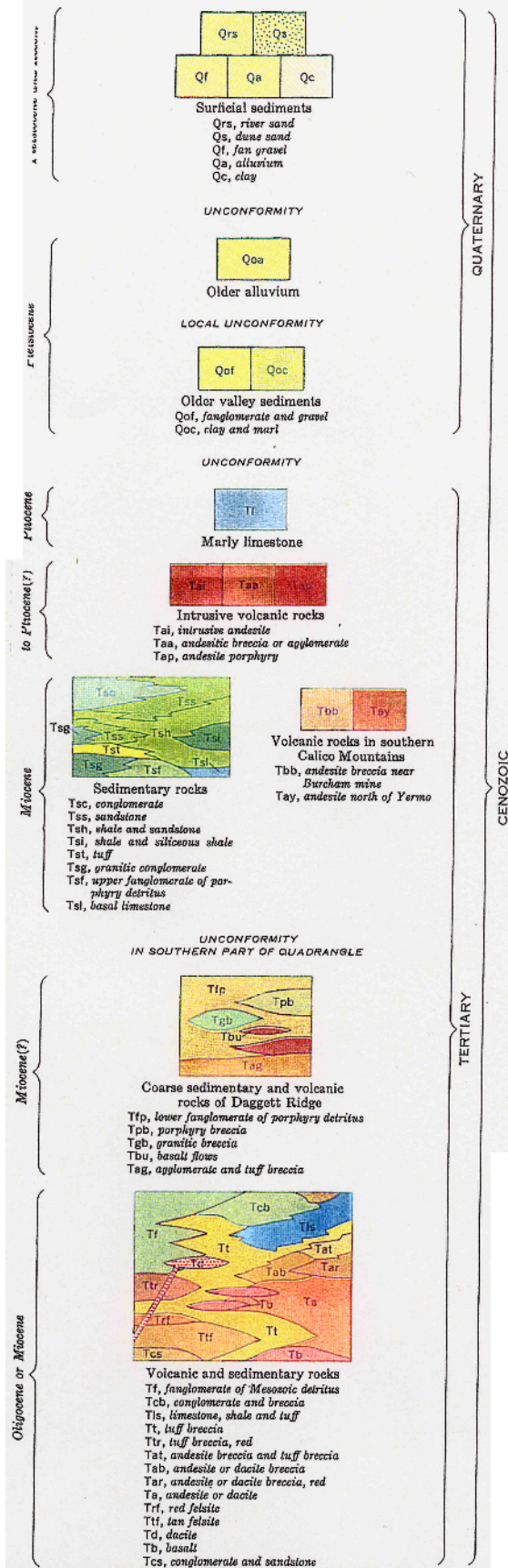
MCLB Barstow, California



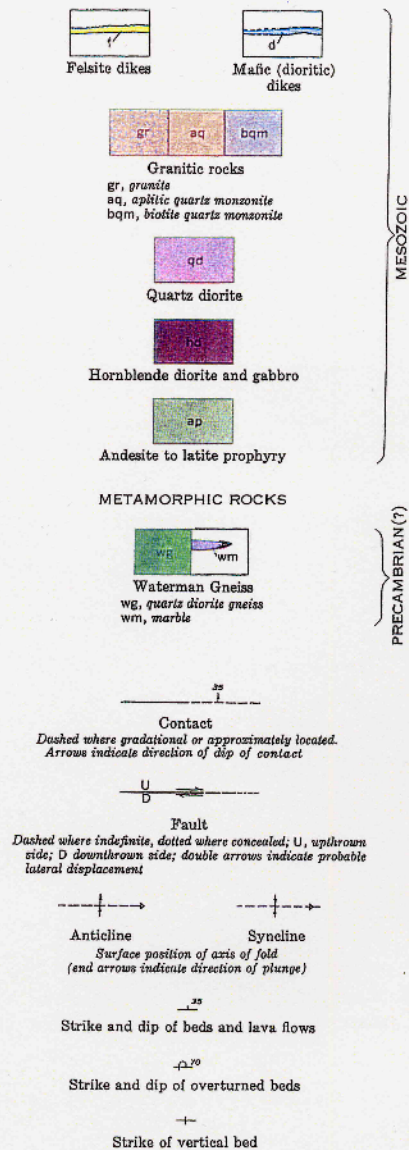
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File No.: 026G11330
Job No.: 23818-026
Rev No.: D

SEDIMENTARY AND VOLCANIC ROCKS



UNCONFORMITY HYPABYSSAL AND PLUTONIC IGNEOUS ROCKS



SOURCE:

DIBBLEE 1970 (U.S. GEOLOGICAL SURVEY, MISCELLANEOUS GEOLOGIC INVESTIGATIONS, MAP I-592)

OU 7 Remedial Investigation Report

Figure 3-4

Explanation of Local Geology

MCLB Barstow, California



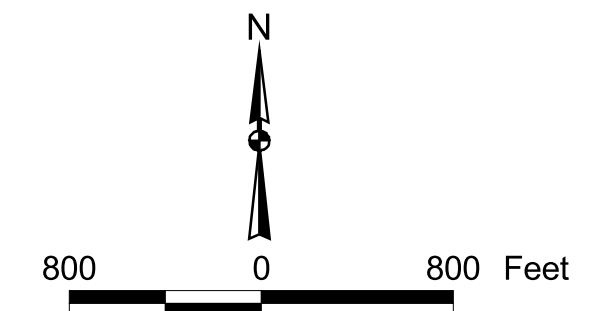
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 Rev No.: C

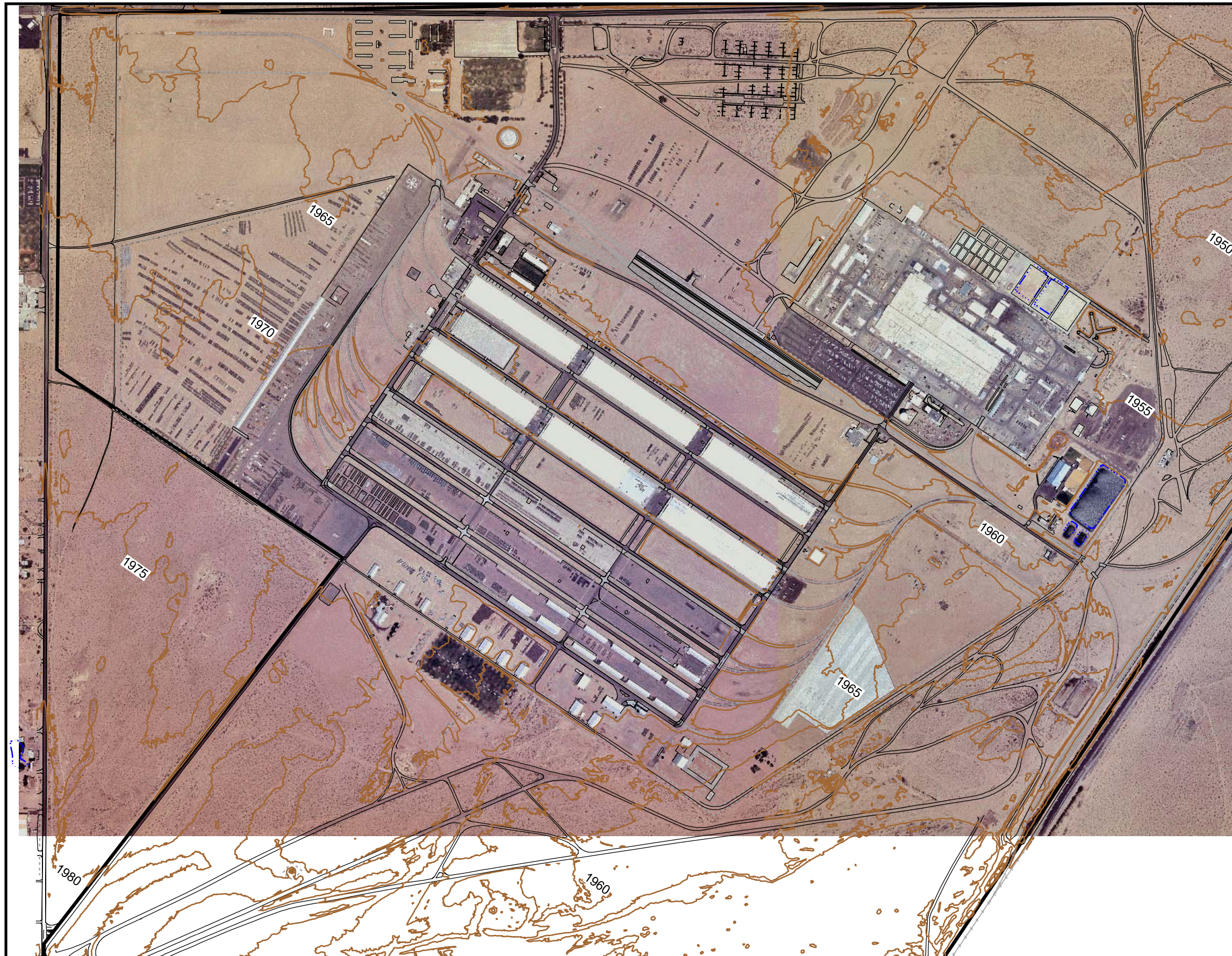


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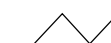






- GROUND SURFACE ELEVATION CONTOUR
IN FEET ABOVE MEAN SEA LEVEL; CONTOUR
INTERVAL IS 5 FEET
- ROAD/CURB/OTHER SURFACE FEATURE
- RAILROAD
- FENCE
- DRAINAGE DITCH
- BUILDING OR STRUCTURE

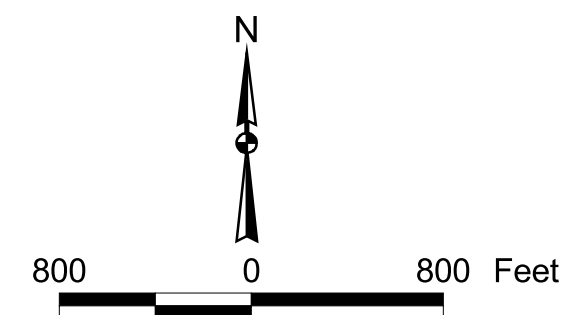


OU 7 Remedial Investigation Report	
Figure 3-7	
Ground Surface Topography Nebo Main Base	
MCLB Barstow, California	
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LEGEND

-  GROUND SURFACE ELEVATION CONTOUR
IN FEET ABOVE MEAN SEA LEVEL; CONTOUR
INTERVAL IS 5 FEET
-  ROAD/CURB/OTHER SURFACE FEATURE
-  RAILROAD
-  FENCE
-  DRAINAGE DITCH
-  TANK
-  BUILDING OR STRUCTURE
-  ANNEX BOUNDARY



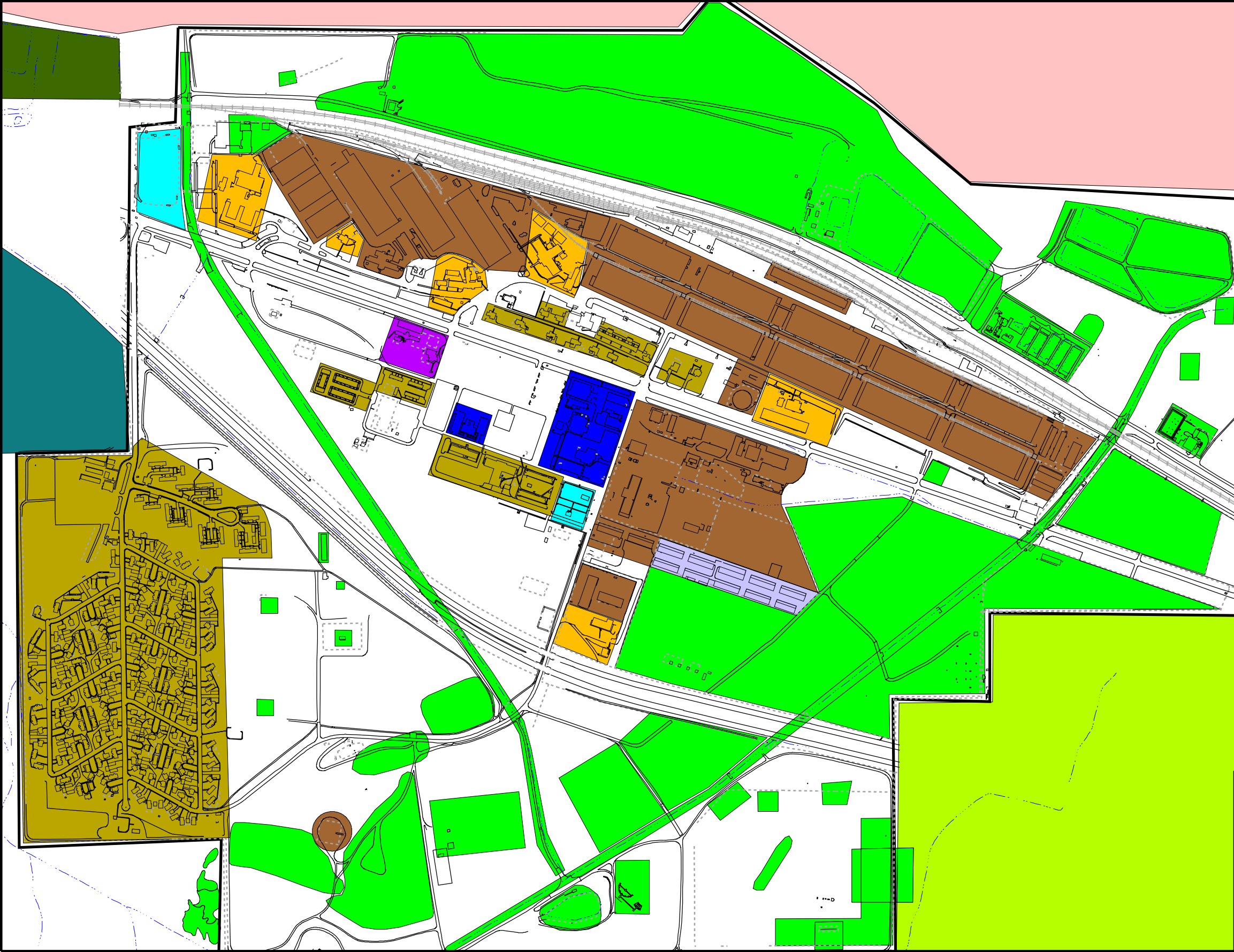
Remedial Investigation Report
Figure 3-8
Ground Surface Topography Yermo Annex

MCLB Barstow, California



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File No.: 026L11328
Job No.: 23818-026
Rev No.: B



LEGEND

- ROAD/CURB/OTHER SURFACE FEATURE
- RAILROAD
- FENCE
- DRAINAGE DITCH
- BUILDING OR STRUCTURE
- RESIDENTIAL HOUSING
- SCHOOL/DAYCARE
- ADMINISTRATIVE OFFICES (INCLUDING RECREATIONAL AND HEALTH FACILITIES, FIRE, ETC.)
- COMMISSARY, GAS STATION, RESTAURANT
- INDUSTRIAL-TYPE FACILITIES
- PARKS, OUTDOOR RECREATIONAL FACILITIES
- ENVIRONMENTAL SITES (AOCs, USTs, CAOCs, ETC.)
- ENVIRONMENTAL SITES (AOCs, USTs, CAOCs, ETC.) AND INDUSTRIAL-TYPE FACILITIES
- RURAL RESIDENTIAL
- SAND, GRAVEL MINING
- FLOOD PLAIN
- CITY OF BARSTOW EVAPORATION BASINS

N

800 0 800 Feet

OU 7 Remedial Investigation Report
Figure 3-9
Land Use Map
Nebo Main Base

MCLB Barstow, California



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Job No.: 23818-026
Rev No.: C

Section 4

NATURE AND EXTENT OF CONTAMINATION

This section summarizes the nature and extent of reported concentrations and spatial distribution of contaminants at the seven CAOCs as presented in Attachments A through G. Soil analyte concentrations were compared to LUFT (for TPH) and PRG (residential and industrial) criteria. Metals soil data were also compared to MCLB Barstow background concentrations (JEG 1994). Groundwater data were compared to California and federal MCLs and tap water PRGs when MCLs were not available.

4.1 CAOC 9.60

Soil gas, soil, and groundwater sampling was conducted at CAOC 9.60 during the RI and previous investigation. Results are summarized on Figures 4-1, 4-2, and 4-3 of Attachment A.

Results of sampling and analysis at CAOC 9.60 indicate that the only site-related contaminants reported in soil samples at concentrations above established regulatory criteria are TPH and tetrachloroethene (PCE). Reported concentrations above regulatory criteria are limited in extent to the east end of the former UST excavation area, where waste-oil-saturated soil and the buckled end of the UST were observed during UST removal activities. TPH concentrations in a nearby boring (less than 5 feet laterally from the boring with reported TPH above LUFT criteria) were below LUFT criteria, indicating a limited lateral extent of TPH-impacted soil. TPH concentrations in soil decrease vertically to below laboratory detection limits or are below LUFT criteria.

Concentrations of PCE (as well as other VOCs) in soil gas also decrease overall with depth. Analytical results from samples collected during the ERFA and RI support the conclusion that n-nitroso-di-n-propylamine concentrations reported during the RFA were a laboratory artifact and unrelated to base activities (JEG 1996).

Reported concentrations of contaminants in groundwater were below established regulatory criteria, with the exception of chloroform and PCE. Chloroform was the only VOC reported (0.87 micrograms per liter [$\mu\text{g/L}$]) in the sample from the groundwater monitoring well (9.60-MW-1) downgradient of the former UST location.

4.2 CAOC 10.27

Soil and groundwater sampling was conducted at CAOC 10.27 during the RI and previous investigations. Results are summarized on Figure 4-1 of Attachment B.

Results of soil sampling and analyses at CAOC 10.27 indicate that five polynuclear aromatic hydrocarbons (PAHs) (benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]-fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene), all reported dioxin/dibenzofuran concentrations, and four metals (arsenic, iron, lead, and silver) were reported at concentrations exceeding residential PRGs. The lateral extent of PAHs in soil at concentrations exceeding PRGs is limited to the area around the drainage pipe in the Burlington Northern Santa Fe (BNSF) right-of-way. PAHs were not reported at concentrations above PRGs in any soil samples collected below 3.5 feet bgs.

All reported arsenic concentrations exceeded residential and industrial PRGs; however, arsenic exceeded background concentrations in only four soil samples. The elevated arsenic concentrations are normal for the region and are not CAOC related. The lateral and vertical extent of these arsenic concentrations appears to be delineated. Lead was reported at concentrations exceeding residential PRGs in only two soil samples from 10.27S05 at 0.5 foot bgs and N10.27-1 at 3.5 feet bgs. Subsequent soil sample results from the RI from borings adjacent to these locations did not indicate the presence of lead exceeding residential PRGs. Lead was not reported at concentrations exceeding PRGs or background at depths greater than 10 feet bgs.

Groundwater results from 10.27-RI4 indicate that the SVOCs di-n-butyl phthalate and diethyl phthalate are present but at concentrations below tap water PRGs, and that lead is not present in groundwater at concentrations exceeding the laboratory detection limit.

4.3 CAOC 10.35

Soil and groundwater sampling was conducted at CAOC 10.35 during the RI and previous investigations. Results are summarized on Figure 4-1 of Attachment C.

Extensive sampling was conducted over the entire area of CAOC 10.35 during the RI and previous investigations (Figure 4-2, Attachment C). Twenty-two borings were located throughout the CAOC during these investigations (including the locations of the former clarigesters). The results of the soil sampling indicate that PRGs were exceeded for only Aroclor 1260, dieldrin (reported in one sample above its residential PRG), and arsenic (naturally occurring). Soil sampling at CAOC 10.35 was sufficient to vertically and laterally delineate these PRG exceedances.

The relatively low concentrations of VOCs (less than 1 µg/L) reported in groundwater crossgradient of the CAOC at monitoring well MW-F are attributed to the North VOC Groundwater Plume. The pesticide 4,4'-dichlorodiphenyltrichloroethane (DDT) was also reported in groundwater from boring 10.35-RI1A but not in soil at CAOC 10.35. Therefore, CAOC 10.35 is not believed to be the source of this 4,4'-DDT.

4.4 CAOC 10.37

Extensive sampling was conducted throughout CAOC 10.37 during the OU 7 RI and previous investigations. Soil gas, soil, and groundwater sampling and analyses at CAOC 10.37 are summarized on Figures 4-1 and 4-2 of Attachment D.

4.4.1 Soil Gas

Soil gas data indicate that the presence of acetone, PCE, and TCE at concentrations from 0.02 to 139 µg/L is limited to the northern area of Evaporation Basin 2 at depths to 20 feet bgs. Fuel-related VOCs (toluene and xylenes) were reported in soil gas at five locations across the CAOC at concentrations from 0.54 to 1.7 milligrams per liter (mg/L) at depths from 5 to 20 feet bgs.

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Chloroform was reported in samples from the eastern portion of the CAOC. The one exception was a reported concentration from the southern end of Evaporation Basin 2. Chloroform was also reported in soil gas from several borings north of Evaporation Basin 5 and from two borings along the southern CAOC boundary. Chloroform is likely a by-product of the reaction between chloride (sourced from ferrous chloride used as a flocculant during historic wastewater treatment activities) and organic material. The presence of chloroform at the CAOC could also have resulted from the breakdown of calcium hypochlorite (reportedly stored in the area in the 1940s and 1950s) and the reaction of chloride with organics. The OUs 5 and 6 RI indicated that industrial waste treatment plant (IWTP) evaporation basins were the most likely source of the chloroform but concluded that it is unlikely that any calcium hypochlorite would remain in the near-surface soil for over 40 years (JEG 1996).

4.4.2 Soil

TPH as diesel and TPH as motor oil were reported in the shallow soil (0 foot to 10 feet bgs) or at concentrations decreasing with depth, with the exception of a reported diesel concentration from boring B-8. This boring was located in the western portion of the CAOC, downgradient of the former UST T-325 release. Diesel-impacted soil in this boring is the result of diesel-impacted groundwater from the UST release. This former UST was recommended for site closure in 2003 (Brown and Caldwell 2003). TPH impacts to shallow soil are from former CAOC-related activities. The vertical and lateral extent of TPH in soil has been defined by deeper samples and/or adjacent borings.

Seven SVOCs (all PAHs) were reported in soil at concentrations exceeding PRGs at a maximum depth of 5 feet bgs. In all but one boring (N10.37-8), the vertical extent of PAHs has been defined by deeper samples. These PRG exceedances were reported in soil samples from the western portion of the CAOC (boring N10.37-1) located near the wet well, in the western sludge-drying bed, north of Evaporation Basins 4 and 5, and southeast of Evaporation Basin 5. PAHs at concentrations exceeding PRGs in the area north of Evaporation Basin 5 and in the western sludge-drying bed are defined laterally and vertically. However, the extent of PAHs has not been defined in the following three areas:

- north and northwest of Evaporation Basin 4
- south of boring N10.37-1
- south and east of Evaporation Basin 5

There is more than one likely source for PAHs in soil at CAOC 10.37. CAOC-related sources include the sludge-drying beds, evaporations basins, wet well, and water overspray blown from the evaporation basins by the aeration sprinklers on windy days. A non-CAOC-related source for the PAHs in soil is the presence of clay target fragments from the adjacent skeet and trap range that was present in the eastern part of the CAOC before the IWTP was constructed. At CAOC N-2 Area 1, which also overlaps a former skeet and trap range (CAOC 4), analysis of a clay target fragment and shallow soil samples indicated that the PAHs reported in soil samples were directly related to clay

target fragments (Attachment F). Figure 4-6 (Attachment D) shows a comparison of PAH results in representative surface soil samples from the area north of Evaporation Basins 4 and 5 with PAH results in representative soil samples from the adjacent skeet and trap range (CAOC 4) and the clay target fragment and surface soil sample from CAOC N-2 Area 1. The reported specific PAH compounds are similar for the soil and clay target fragment samples, indicating that clay target fragments from the former skeet and trap range are one likely source of PAHs in the northeast portion of CAOC 10.37.

4.4.3 Groundwater

Groundwater samples were not collected during the OU 7 RI because contaminants reported in groundwater beneath CAOC 10.37 were not identified for further investigation based on the monitoring results of previous investigations (BEI 2003). Groundwater sampling results from the UST T-325 site assessment indicated the presence of TPH and fuel-related constituents, probably from the former UST. More recent groundwater monitoring activities in 1999 indicated the presence of chloroform, toluene, and five metals at concentrations below MCLs. Monitoring after 1999 did not indicate the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX), SVOCs, or fuels in groundwater, and the former UST T-325 has been recommended for site closure (Brown and Caldwell 2003).

4.5 CAOC 10.38/10.39

Soil gas, soil, and groundwater samples were collected at CAOC 10.38/10.39 during the RI and previous investigations. Results are presented on Figures 4-1 through 4-5 of Attachment E. To use the data collected most efficiently, the domestic wastewater collection (DWC) and industrial wastewater collection (IWC) line segments were divided into Units 1 through 7. The following is a summary of the nature and extent of contamination for each of these units.

- Unit 1 (DS1 and IS1) – The results of soil gas, soil, and groundwater sampling conducted in the vicinity of these collection lines do not suggest that a release from DS1 or IS1 has occurred. VOCs reported in groundwater are likely related to North VOC Groundwater Plume.
- Unit 2 (DS3 and IS2) – Soil gas and soil sampling were conducted adjacent to offset pipe joints and break zones located downgradient of facilities suspected to have discharged industrial wastes into these collection lines. The results of this sampling do not suggest that a release from DS3 or IS2 has occurred.
- Unit 3 (DS9) – Soil gas and soil sampling were conducted adjacent to several facilities suspected to have discharged industrial wastes into DS9 as well as adjacent to a severe offset pipe joint located downgradient of these facilities. The results of this sampling do not suggest that a release from DS9 has occurred.
- Unit 4 (DS11 and IS4) – The results of sampling from this unit do not suggest a release from DS11 or IS4 has occurred in the areas sampled. The sampling

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results at 10.38-DS14-2 and 10.38-DS14-2A also indicate that collection line breaks are not the source of the VOCs at Building 322.

- Unit 5 (DS12) – The results of sampling at this unit do not suggest a release from DS12 has occurred.
- Unit 6 (DS14) – The results of sampling at these boring locations do not suggest a release from DS14 has occurred in these areas. In addition, these results suggest that the documented breaks in collection line DS14 are not the source of VOCs reported at 10.38V16.
- Unit 7 (DS17) – This unit consists of drainage ditches (not buried discharge lines). DS17 was addressed under the DWC lines for convenience (Figure 4-1 of Attachment E). The results of sampling indicate that low concentrations of VOCs (TCE was reported at concentrations exceeding MCLs, and naphthalene was reported at a concentration exceeding its Cal-Modified tap water PRG) were reported in groundwater and were distributed sporadically in the general area extending from 10.38-DS17-2 northeastward to 10.38-DS17-3. The original VOC sources are no longer discernible and are not likely a present or potential source of groundwater contamination. Based on sampling results, the VOCs present in soil around Building 322 do not appear to be related to DS17.

4.6 CAOC N-2 AREA 1

Soil samples were collected at CAOC N-2 Area 1 during the RI and previous investigations. Results are presented on Figure 4-1 of Attachment F. Based on RI sampling results at CAOC N-2 Area 1, the extent of PAHs in shallow soil appears to be directly related to the presence of clay target fragments from activities at the former skeet and trap range, which is not a part of this CAOC. A comparison of the PAH results from the clay target fragment sample and soil samples indicate the following.

- The maximum reported PAH concentrations were from the clay target fragment sample.
- The PAHs reported in the clay target fragment sample are the same as those reported in soil samples at CAOC N-2 Area 1.
- The PAHs reported in the clay target fragment sample are similar in composition (analytes reported) and in relative concentration to those reported in soil samples at CAOC N-2 Area 1.
- SVOCs (PAHs) were not reported in soil samples collected below 0.5 foot bgs.
- Elevated PAH concentrations coincide with areas with the highest densities of clay target fragments.

The estimated extent of the clay target fragments interpreted from soil sampling results and aerial photography is shown on Figure 4-1 of Attachment F.

The extent of the PCB Aroclor 1254 (reported at a concentration exceeding the residential PRG) appears limited to the southern central portion of the CAOC in the area of boring AOCN2-A1-2.

4.7 CAOC 10

Soil gas and soil samples were collected at CAOC 10 during the RI. Results are presented on Figures 4-1 and 4-2 of Attachment G. Twenty-two soil borings were randomly located throughout the CAOC, and 12 trenches were excavated in the locations of anomalies identified during a geophysical survey conducted prior to the RI fieldwork. The results of the soil sampling at these locations indicate that reported concentrations of VOCs, SVOCs, herbicides, PCBs, and pesticides were below PRGs. All dioxins/dibenzofurans were reported at concentrations exceeding residential PRGs at least once. Six target analyte list (TAL) metals (arsenic, iron, lead, selenium, sodium, and zinc) were reported above background and/or residential PRGs. Soil sampling was sufficient to vertically and laterally delineate these TAL metal exceedances.

Section 5

CONTAMINANT FATE AND TRANSPORT

This section is an overview of the fate and transport mechanisms that are common at the OU 7 CAOCs. Site-specific fate and transport analyses are provided in the attachments to this report. The fate and transport analysis is used to assess the physical and chemical changes that may occur to contaminants and to analyze transport mechanisms that may act upon them.

Section 5.1 presents a basewide conceptual model. This model incorporates physical characteristics, nature and extent of contamination, migration pathways, and intermedia transport mechanisms that are shared by most of the OU 7 CAOCs. This basewide model is used to identify the primary contaminant migration pathways that pose the greatest potential to impact the environment.

Section 5.2 presents a discussion of the fate of the contaminants that have been identified at the individual CAOCs. For purposes of this discussion, fate refers to the physical and chemical properties of each group of contaminants (e.g., VOCs, SVOCs, and inorganics) that affect contaminant transport and persistence in the environment. The discussion of fate includes general characteristics for organic and inorganic compounds, as well as specific characteristics for groups of contaminants identified at the individual sites.

Section 5.3 presents a discussion of transport pathways that are common at most of the OU 7 CAOCs. This section summarizes the climatic conditions, site physical characteristics, and contaminant distributions that lead to conclusions about viable transport pathways at the CAOCs.

5.1 CONCEPTUAL MODEL

This section summarizes the pertinent geologic/hydrologic, surface-drainage, and climatic factors that influence the fate and transport of contaminants reported for this RI. It also summarizes the distribution of contaminants in soil, surface water, sediment, and groundwater. These summaries form the basis of the discussion of potential contaminant migration pathways. These pathways complete the conceptual model.

5.1.1 Physical Characteristics

Basewide physical characteristics common to OU 7 are discussed in Section 3. The following subsections highlight those factors that significantly impact fate and transport of contaminants.

5.1.1.1 SURFACE SOIL

Soil units that predominate at OU 7 include the Cajon-Manet and Yermo-Kimberlina-Typic Haplargids. The soil unit profiles (up to 60 inches) range from sand and loamy sand to cobbly and gravelly sandy loam. These soil units develop on alluvial fans and are generally well drained, with slopes from 0 to 50 percent (USDA 1986).

As indicated in Section 3.1.1, in general, OU 7 CAOCs are partially or completely unpaved, and at the time of the RI there was minimal vegetation. Minimal vegetation on unpaved surfaces may result in increased potential for erosion by wind or surface water.

Stormwater could carry contaminants in dissolved or colloidal form or associated with suspended soil particles (Section 5.1.1.2).

The potential for migration of contaminants through surface soil to groundwater is expected to be minimal due to the desert climate (Section 5.1.1.6), lack of a significant driving force, and depth to groundwater. Percolation/infiltration from precipitation at the CAOCs is expected to be low because of the low average annual rainfall in the area (less than 4 inches per year) relative to the high evapotranspiration rates (greater than 70 inches per year).

5.1.1.2 SURFACE WATER

As noted in Section 5.1.1.1, during the RI most of the CAOCs were partially or completely unpaved with minimal vegetation. Stormwater runoff under these conditions could potentially carry contaminants present in surface soil at the CAOCs off-site. Waterborne contaminants can be transported by traction, saltation, and suspension of particulates, or as solutes or colloids in the surface water itself. The amount, frequency, duration, and intensity of rainfall, type of contaminant, surface soil properties, surface cover extent (e.g., pavement), and topography of the area affect surface water transport.

At Nebo Main Base, during intense storms, runoff would flow north towards the Mojave River. Several drainages are present within the Nebo Main Base to convey stormwater to the Mojave River (Figure 3-6). At Yermo Annex, stormwater runoff is also collected in drainages that flow toward the Mojave River south of the annex. An evaluation of CAOC-specific potential for stormwater or surface water runoff is presented in Sections 5.1.1 and 5.3.2 of the attachments to this report.

5.1.1.3 GEOLOGY

MCLB Barstow is located in the west-northwest-trending Barstow Basin. Exposed bedrock consists primarily of Tertiary sedimentary and volcanic rocks. The basin is filled by a sequence of late Tertiary to Quaternary alluvial deposits. The surface is mantled by windblown deposits and young alluvial deposits derived from the Mojave River and/or shed from adjacent highlands. The southern portion of Nebo Main Base is underlain by coarse alluvial-fan debris containing abundant gravel and cobbles (Dibblee 1970). The northwest trending Camp Rock-Harper Lake Fault zone is present in the northeast portion of Nebo Main Base (USGS 1997).

5.1.1.4 REGIONAL HYDROGEOLOGY

MCLB Barstow is located within the Mojave River drainage basin (Hyatt 1934). The Mojave River riverbed is generally dry (ephemeral), and flow in the Barstow area is limited to periods of heavy rain (storm runoff). The USGS identified two aquifers in the Mojave River drainage basin: the floodplain aquifer along the Mojave River channel (also described as the “shallow alluvial aquifer” and the “Mojave River aquifer”) and the regional aquifer that underlies and surrounds the floodplain aquifer (Stamos et al. 2001). Regional groundwater flow in the Mojave River drainage basin is generally directed to the east to northeast (Stamos et al. 2001).

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5.1.1.5 LOCAL HYDROGEOLOGY

The Mojave River drainage basin consists of a series of subbasins separated by relatively impermeable bedrock. MCLB Barstow is within the Lower Mojave subunit (DWR 1967). The Lower Mojave subunit is further subdivided into several subbasins; Nebo Main Base and Yermo Annex are within the Barstow and Yermo subbasins, respectively.

At Nebo Main Base, monitoring well gauging data collected for the year 2002 indicate that the depth to groundwater ranged from about 10 feet bgs in the north near the Mojave River to about 210 feet bgs at the southern boundary of the base (FWEC 2003). The observed groundwater flow patterns indicate a significant influence from the Camp Rock-Harper Lake Fault zone. Five northwest-trending strands in the area of Nebo Main Base define the northwest-trending Camp Rock-Harper Lake Fault zone. One of these strands, shown on Figure 3-5, forms a groundwater barrier that impedes groundwater flow across the Nebo Main Base area (Stamos et al. 2001). East of this fault zone strand, the groundwater flow was generally to the southeast with a fairly consistent hydraulic gradient averaging 0.0031 foot per foot during 2002 (FWEC 2003). West of this fault zone strand, groundwater flow was generally east-northeast. The other fault zone strands do not appear to impact groundwater flow.

At Yermo Annex, data collected for the year 2002 indicate that the depth to groundwater ranged from about 153 to 174 feet bgs (FWEC 2003). The general groundwater flow direction in the northern portion of Yermo Annex was from west to east and in the southern portion was from west/southwest to east/northeast (FWEC 2003).

5.1.1.6 CLIMATE

The climate in the Barstow area is typical of deserts in the southwestern United States. During the summer months, daytime high temperatures are generally from 100 to 110 °F, with occasional highs greater than 125 °F. Winter daytime high temperatures range from the high 40s to the mid-60s °F, and winter lows below freezing are not uncommon. The prevailing wind direction throughout the entire year is from the west with average wind speeds of approximately 10 to 15 miles per hour. Higher wind speeds are not uncommon, with wind speeds above 19 miles per hour occurring approximately 15 percent of the time, based on wind data in the OUs 5 and 6 RI (JEG 1996).

The mean annual rainfall is approximately 4 inches with a 24-hour maximum precipitation that rarely exceeds 3 inches (NOAA 1993). The potential evaporation is probably greater than 70 inches per year, which far exceeds the average precipitation (DWR 1967). Infiltration is usually estimated to be approximately 10 percent of the annual rainfall (Walton 1989). For MCLB Barstow this would result in an annual recharge rate of only 0.4 inch. Based on other CAOC-specific factors including the high evapotranspiration rates, net infiltration from precipitation at MCLB Barstow may be even less than the estimated 0.4 inch.

5.1.2 Distribution of Contaminants

A general discussion of the nature and extent of contamination at the OU 7 CAOCs is presented below. Section 4 of each attachment presents CAOC-specific results. The following summary is presented to complete the conceptual model.

5.1.2.1 SOIL

Past activities at OU 7 have impacted soil. Soil contamination is generally the result of spills, leaks, and discharges of fuels, oils, and other waste substances onto the ground surface. Contaminants include VOCs, PAHs, fuels, pesticides, PCBs, and TAL metals. Most contaminants are reported in shallow soil (0 foot to 13 feet bgs).

5.1.2.2 GROUNDWATER

The data collected suggest that groundwater has not been impacted by previous activities at CAOCs 10.27, 10.35, 10.37, N-2 Area 1, and 10. It appears that low net infiltration rates coupled with relatively low soil contamination and the type of contamination have resulted in minimal contamination outside of the shallow-soil interval at these CAOCs.

In contrast, previous activities at CAOC 9.60 have impacted groundwater, where UST T-530B released waste oils and other waste liquids that migrated through the vadose zone, ultimately to groundwater. At CAOC 10.38/10.39, Unit 7 groundwater has been impacted in the area of sampling locations DS17-2 and -3.

5.1.2.3 SURFACE WATER AND SEDIMENT

Surface water and sediment were not sampled as part of the RI for OU 7. As identified in Sections 5.1.1.1 and 5.1.1.2, there is a potential for contaminants to be transported, particularly by stormwater runoff during infrequent desert thunderstorms. The amount, frequency, duration, and intensity of rainfall, type of contaminant, surface soil properties, surface cover extent (e.g., pavement), and topography of the area affect surface water transport of contaminants.

5.1.3 Potential Routes of Migration

There are three primary contaminant migration pathways that are potential routes for the transport of contaminants: air, groundwater, and surface water/sediment. The following sections summarize the characteristics of the contaminant migration pathways at the OU 7 CAOCs.

5.1.3.1 AIR PATHWAY

Dry conditions and consistent winds prevalent at MCLB Barstow create the potential for mobilization of contaminants through air. Chemicals may be transported in the air as volatile constituents or in association with fugitive dust. Volatilization into air is controlled by the chemical properties of a possible contaminant, its proximity to the surface, vapor pressure, and the barometric pressure. The generally low volatility of most of the chemicals reported at OU 7 CAOCs will limit transport by direct volatilization

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to air. Transport in association with fugitive dust is facilitated by exposure of surface soils to moderate-to-high winds across the surface. Vegetation and ground covering (e.g., concrete) are not present on the surface of many of the CAOCs, increasing the tendency of the CAOCs to generate fugitive dust.

5.1.3.2 GROUNDWATER PATHWAY

Depth to groundwater at the CAOCs ranges from approximately 35 feet bgs at CAOC 10.35 to over 165 feet bgs in the area of CAOC 10. At CAOCs 10.27, 10.35, 10.37, N-2 Area 1, and 10, the volume of contaminants released into soil, depth to groundwater, and low rainfall/infiltration appear to have minimized the potential for migration of the contaminants in the subsurface and, as a result, groundwater has not been impacted below these CAOCs. For this reason, groundwater was considered an incomplete pathway at these CAOCs.

Groundwater has been impacted at CAOCs 9.60 and 10.38/10.39. The circumstance at both CAOCs is likely related to the volume of contaminants released into the subsurface at these locations. At CAOC 9.60, contaminants (VOCs and petroleum hydrocarbons) were released from a large-volume (40,000-gallon capacity) leaking UST. Concentrations of these contaminants in the vadose zone at CAOC 9.60 may still represent a threat to groundwater; however, their mobility is significantly reduced due to minimal infiltration. VOCs and hydrocarbons in the vadose zone are also being retarded by natural processes (e.g., oxidation and volatilization). At CAOC 10.38/10.39 Unit 7 (drainage ditches), contaminants (VOCs) may have been released to the ground surface and/or via drainages. Although this was an active pathway in the past at CAOC 10.38/10.39, industrial waste is no longer being discharged in this manner. Therefore, the present concentrations of VOCs in the vadose zone at CAOC 10.38/10.39 are not likely to represent a threat to groundwater.

5.1.3.3 SURFACE WATER/SEDIMENT PATHWAY

Waterborne contaminants can be transported by traction, saltation, and suspension of particulates or as solutes or colloids in the surface water. Surface water transport is affected by the amount of rainfall, type of contaminant, surface properties, and topography of the area. The surface water pathway allows transport of chemicals from the CAOC to the surrounding area. Contaminants most likely to be transported in association with suspended colloids or particulates would be those compounds that are tightly sorbed to soil particles. At the OU 7 CAOCs, these include metals, petroleum hydrocarbons, SVOCs (including PAHs), pesticides, and PCBs. Highly water-soluble chemicals could be transported as solutes in surface water. VOCs at the OU 7 CAOCs have the greatest water solubility and would most likely be transported as solutes.

5.2 CONTAMINANT MOBILITY AND PERSISTENCE

Contaminant mobility refers to the tendency of a contaminant to move along a pathway in response to a driving force. Contaminant persistence refers to the tendency of a chemical to resist transformation or degradation. A chemical that is immobile and persistent in the

environment tends to remain in place. The tendency toward immobility and persistence is a function of site-specific characteristics and the physical and chemical properties of the contaminants. Such properties include solubility, tendency to transform or degrade (usually described by a half-life or an environmental half-life in a given medium), and chemical affinity for solids or organic matter (usually described by a partitioning coefficient).

This section presents the specific physicochemical parameters of selected chemicals reported at OU 7 CAOCs. Chemical groups for each CAOC are discussed in relation to their mobility and persistence in the CAOC-specific attachments to this report. To facilitate the presentation of the physicochemical parameters, CAOC-specific contaminants reported in soil gas, soil, and groundwater are listed in Tables 5-1 through 5-30. As described below, each chemical group has similar physicochemical properties that influence contaminant mobility or persistence in the environment.

5.2.1 Organics

The mobility or persistence of organic compounds is governed by their physicochemical properties and the transformation mechanisms that act on them.

5.2.1.1 PHYSICOCHEMICAL PROPERTIES

The relevant physicochemical parameters for the organic chemicals reported at the OU 7 CAOCs include water solubility, vapor pressure, Henry's law constant, and organic carbon-to-water partitioning coefficient (K_{oc}), as listed in Table 5-31.

The solubility of a contaminant in water is a key parameter that affects the transport of solutes via the water medium. Highly soluble substances can be rapidly leached from soil and transported via surface water or transported to groundwater where they remain in a dissolved state as groundwater moves through the subsurface. Solubilities of organic chemicals generally range from less than 0.001 mg/L to greater than 100,000 mg/L.

Volatilization is the process by which liquids and solids vaporize and escape to the atmosphere. The volatility of a chemical in its pure state is dependent on its vapor pressure. Vapor pressure is the pressure (often expressed in millimeters of mercury) of a vapor in equilibrium with its liquid or solid form at a given temperature. Vapor pressure typically ranges from 1×10^{-7} to 760 millimeters of mercury at 25 degrees Celsius ($^{\circ}\text{C}$) for liquids, with the higher values indicating greater tendency to volatilize or enter the gas phase.

Henry's law constant is based on the equilibrium relationship between the solubility of a gas in water and the partial pressure of the gas in the atmosphere above the water. Henry's law constant reflects the tendency of a gas dissolved in liquid to transfer to the atmosphere and differs from volatilization. Henry's law constant is important if the contaminant exists as a gas in groundwater or surface water. The greater the value of Henry's law constant, the greater the tendency of the gas to be released into the air and transported in the atmosphere. The lower the constant, the greater the tendency of the gas to remain dissolved in the liquid phase and have the potential to be transported by water.

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K_{oc} is a measure of partitioning tendency of the compound from water to organic matter. The normal range of K_{oc} values is from 1 to 1×10^7 , with higher values indicating greater sorption potential. Empirical relationships have been developed between K_{oc} and the distribution coefficient (K_d). The most common relationship assumes the following form:

$$K_d = f_{oc} \times K_{oc}$$

where

f_{oc} = fractional organic carbon content of the soil

K_d = distribution coefficient (proportional to the soil retardation factor)

Fractional organic carbon (f_{oc}) content can be determined from total organic carbon values. Total organic carbon content was determined for soil samples collected at each of the seven CAOCs. These results are included in each Table 3-1 in Attachments A through G. The values for f_{oc} and the specific K_{oc} value for a given organic chemical can then be used to estimate whether the chemical is more likely to be associated with the soil or water phase. The above empirical relationship can include the effects of several specific phenomena that affect the aqueous transport of chemicals through porous media; cation exchange, absorption, adsorption, precipitation, and complexation can all affect the mobility of chemicals in soil. Adsorption is usually the most significant mechanism controlling mobility of organic compounds (Howard et al. 1991).

Numerous soil properties can also affect the aqueous transport of chemicals through porous media: soil-particle size, clay mineral composition, pH, cation-exchange capacity, and organic carbon content. Soil organic carbon content is usually the most important soil property controlling mobility of organic compounds (Howard et al. 1991).

In general, organics with higher water solubilities and vapor pressures and lower K_{oc} values (e.g., VOCs) tend to have greater volatility and lower sorption potential, resulting in greater mobility in liquid and gaseous media. Organics with lower water solubilities and vapor pressures and higher K_{oc} values (e.g., PCBs, pesticides, and PAHs) have higher potential to remain sorbed to soil, lowering their mobility in liquid and gaseous media.

5.2.1.2 TRANSFORMATION PROCESSES

Transformation processes acting on organic chemicals in the natural environment include biodegradation, hydrolysis, oxidation-reduction, and photodecomposition. In all cases, new chemical compounds are formed as a result. The time that is required to degrade half the mass of a chemical is referred to as the half-life. Half-life times for selected organic compounds reported at the OU 7 CAOCs are presented in Table 5-31.

Biodegradation involves the conversion of organic compounds with reactions controlled by living organisms, primarily microbes. Biodegradation can occur either aerobically (with oxygen as the electron acceptor) or anaerobically (another element/compound is used as the electron acceptor). Biodegradation is influenced by a number of factors such as availability of electron acceptors, pH, temperature, water content, organic carbon concentration, and biological factors (e.g., microbial species and population density).

Biodegradation rates can also be influenced by nutrient concentrations and diffusion rates of the contaminants.

Biodegradation can have a significant impact in the degradation of organic compounds in the natural environment. It is usually much more rapid than abiotic processes under both aerobic and anaerobic conditions. The end products of biodegradation processes are simple chemicals such as carbon dioxide, methane, water, and chloride. An evaluation of monitored natural attenuation for groundwater contamination at OU 2 at MCLB Barstow was conducted in 1999 (Parsons 1999). Results of this evaluation indicated that biodegradation is not a significant environmental fate process for the OU 2 groundwater plume as evidenced by the lack of favorable breakdown products and unfavorable geotechnical indicators. Although this study focused on the OU 2 groundwater plume, it can be generally applied to conditions across MCLB Barstow, indicating that biodegradation of VOCs is most likely not a significant attenuation process at the base.

Hydrolysis is a chemical reaction in which water reacts with another substance to form two or more new substances. Hydrolysis reactions are sometimes biologically mediated. Abiotic chemical hydrolysis reactions are a function of parameters such as pH, dissolved organic matter, and dissolved metal ions. These reactions generally occur at a much slower rate than biologic hydrolysis reactions. Dehydrohalogenation, a particular type of hydrolysis reaction, is the primary reaction mechanism for the degradation of many halogenated organic compounds.

Oxidation-reduction reactions involve the transfer of an electron donor to an electron acceptor and may also mediate other reactions (e.g., biological) with contaminants that are present.

Photolysis (photodecomposition) involves the decomposition of an organic compound as a result of the compound absorbing electromagnetic radiation. Typically, photolysis occurs only in the upper 0.5 centimeter of the soil.

Transformation of organic contaminants is discussed further by category below.

Volatile Organic Compounds

VOCs were reported at trace-to-low concentrations (less than 100 micrograms per kilogram [$\mu\text{g/kg}$]) in soil samples at most of the OU 7 CAOCs. Because most of the contaminant releases at the OU 7 CAOCs are believed to have been associated with concentrated spills, the generally common occurrence of VOCs only at low concentrations suggests that these compounds have been transported away from the sites and/or degraded by chemical or biological activity.

The most likely transport pathway away from the CAOC is by volatilization from the surface and near-surface soils into the atmosphere. VOCs could also have migrated away from the source area by diffusion or in association with vadose zone water. However, the impact of these two mechanisms is expected to be minor, due to the slow rate of diffusion of VOCs through soil and the low net-infiltration rates at OU 7 CAOCs.

VOCs are also simultaneously subjected to chemical and biological degradation. Biologically mediated degradation of VOCs typically occurs at much faster rates than

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simple chemical degradation, and microorganisms are known to degrade VOCs under soil conditions similar to those at MCLB Barstow (Howard et al. 1991).

Semivolatile Organic Compounds

Two types of SVOCs, PAHs and phthalates, were reported at OU 7 CAOCs. As chemical classes, PAHs and phthalates generally have low volatility, low water solubility, and a high affinity for sorption to soil organic matter. Low volatility, expressed quantitatively by vapor pressure, constrains vapor-phase transport of PAHs and phthalates in the vadose zone. Low water solubility and strong sorption to soil particles limits the relative importance of leaching through soil as a transport process and causes the PAHs and phthalates to move very slowly relative to percolating infiltration. The sorption behavior of PAHs and phthalates is expressed quantitatively as the K_{oc} value. Table 5-31 summarizes physicochemical properties of selected organic compounds at OU 7 CAOCs.

In shallow soil, biodegradation is the most important transformation process affecting the persistence of PAHs and phthalates. Another potentially important transformation process, photolysis, is limited to areas where surface soils are exposed to sunlight. The persistence of some PAHs is due to their resistance to biodegradation. This resistance is proportional to molecular weight and the number of polar functional groups attached to the PAH aromatic ring structure. High-molecular-weight, multiringed PAHs that do not contain polar functional groups (e.g., pyrene) are the most resistant to biodegradation. As such, they remain in soil for significantly longer periods of time than lower-molecular-weight PAHs containing fewer aromatic rings (e.g., naphthalene) (Howard et al. 1991). Limited data suggest that phthalates may biodegrade in soil under aerobic conditions. In addition, listed half-lives for phthalates (e.g., benzyl butyl phthalate) presented on Table 5-31 are shorter than those of PAHs (e.g., benzo[a]pyrene).

Polychlorinated Biphenyls, Pesticides, and Herbicides

The mobility of PCBs, pesticides, and herbicides is greatly affected by adsorption to organic matter in soil as described above for organic compounds. Generally, these compounds have moderate-to-very-high K_{oc} values, resulting in their strong affinity for organic matter in soil and causing them to be relatively immobile. PCBs, pesticides, and herbicides used in the past also resist the transformation processes described above that can degrade some chemicals, causing them to persist in the soil.

5.2.2 Metals

Because metals are chemical elements and not compounds, they are not subject to the degradation reactions that affect organic compounds. However, metals are vulnerable to oxidation-reduction reactions that can change their valence, species (the form in which a metal is present in solution), and net ionic charge. The characteristics of each metal species can, in turn, strongly influence the transport behavior of that metal in the environment. The basis of this influence is the effect on the partitioning of the metal between soil, organics, and water.

Numerous soil properties also affect the partitioning behavior of metals; soil-particle size (surface area), clay mineral type and composition, pH, cation-exchange capacity, and organic carbon content can all influence the relative importance of a number of partitioning reactions.

Partitioning reactions that determine the distribution of metal species in the soil-water system include ion exchange, adsorption, precipitation, and complexation. The net effect of these diverse, sometimes competing reactions is described as sorption and is measured empirically with a K_d . Due to the multiplicity and complexity of the partitioning reactions that determine the K_d , simplifying assumptions must be used to approximate K_d from literature values. The database used as a reference for Table 5-32 (Streng and Peterson 1989) considers the adsorption potential as the most important geochemical mechanism in determining K_d . The distribution coefficient is expressed as:

$$K_d = \frac{(S)}{(C)}$$

where

- S = mass of solute on the solid phase per unit mass of solid phase
- C = concentration of solute in solution

The K_d is also dependent on a variety of soil characteristics that include soil pH and soil type. The database incorporates the effect of soil pH by dividing the K_d s into three categories based on the range of soil pH values they reflect:

- soils of pH < 5
- soils of pH between 5 and 9
- soils of pH > 9

Only K_d values for the pH 5 to 9 range are presented in Table 5-31 because that category covers the likely pH range of soils at MCLB Barstow.

The effect of soil type on the K_d was also incorporated into the database by dividing the total percent-by-weight composition of the clay, iron, and aluminum and organic matter content of the soils into three categories:

- those sediments whose total weight percent of the aforementioned constituents is < 10
- those sediments whose total weight percent is 10 to 30
- those sediments whose total weight percent is > 30

The three categories correspond roughly to sandy soils (< 10 percent), loamy soils (10 to 30 percent), and clayey soils (> 30 percent). These three types of soil are present at MCLB Barstow.

Although K_d s are dependent on many factors, values based on adsorption potential, soil pH, and soil clay content are expected to provide a reasonable estimate of K_d s applicable

Section 5 Contaminant Fate and Transport

to MCLB Barstow soils. The greater the K_d , the more likely it is that the metal will remain sorbed to soil and not be transported by the water phase.

Most of the soils at the OU 7 CAOCs are well drained and have neutral-to-alkaline pH. These conditions promote a soil environment that should result in very low mobility of most metals.

5.3 CONTAMINANT MIGRATION

The prevailing climatic conditions in the local area provide the following viable transport mechanisms for migration of contaminants at the OU 7 CAOCs:

- atmospheric transport of vapors and fugitive dust
- surface water runoff and transport of contaminated soils and sediment
- at CAOC 9.60 and 10.38/10.39 Unit 7, transport of VOCs to groundwater and subsequent lateral movement in the direction of groundwater flow

This section summarizes the climatic conditions, site physical characteristics, and contaminant distributions that lead to these conclusions.

5.3.1 Atmospheric Transport

Atmospheric transport is considered a viable transport mechanism at all of the OU 7 CAOCs. Contaminated material can be transported in the vapor phase or adsorbed to dust particles.

5.3.1.1 VAPORS

Shallow-soil samples were analyzed for VOCs at OU 7 CAOCs where VOCs were thought to be present. VOCs were reported at trace-to-low concentrations (less than 100 µg/kg) in shallow-soil samples at most of these CAOCs. Atmospheric transport via vapors is a viable transport mechanism at all of the CAOCs where VOCs were reported; however, the concentrations of chemicals that can be transported by this mechanism are not expected to impact air quality on- or off-site. The already low soil concentrations would be further reduced in air by the gradual release of the VOCs to the air and by atmospheric dispersion and mixing as VOCs are transported away from the CAOCs.

5.3.1.2 FUGITIVE DUST

Fairly constant low-to-moderate winds and generally dry climatic conditions are conducive to the formation and transport of dust. These conditions can result in transport of surface-soil contaminants that are adsorbed to the particle surfaces or absorbed into interstitial pore spaces. Contaminants reported in surface-soil samples include metals, SVOCs, PCBs, and pesticides.

Contaminants that are present in surface soil may be carried by wind. The amount of atmospheric transport is based on the erosion potential of the surface, particle size, and wind speed. In addition, dispersion will occur in the atmosphere, causing particle concentrations to undergo dilution as the dust moves off-site.

The presence of ground cover and pavement at CAOCs 10.27, 10.35, 10.37, and 10.38/10.39 (with the exception of Unit 7) tends to reduce the potential for the release of contaminants as contaminated dust. This ground surface is covered by man-made materials (e.g., concrete, asphalt). In these cases, soil is not exposed and, therefore, is unavailable for transport. At CAOCs 9.60, 10.38/10.39 (Unit 7), N-2 Area 1, and 10, soil is exposed and is more readily available for transport as fugitive dust.

5.3.2 Groundwater Transport

At most of the OU 7 CAOCs (except for 9.60 and 10.38/10.39 [Unit 7]), contamination is localized in shallow and surface soils. This is expected to continue due to the low net-infiltration rate into the soil and the relatively low mobility of chemicals remaining in shallow soil. The low infiltration rate is a result of the low average rainfall, pattern of rainfall events, and high evapotranspiration rate.

Transport of contaminants to groundwater, and subsequent lateral transport in the direction of groundwater flow, are considered a viable transport mechanism only at CAOCs 9.60 and 10.38/10.39 Unit 7. These CAOCs differ from the others in one key aspect: release of contaminants at these CAOCs appears to have been more concentrated and to have continued for a longer time. At CAOC 9.60, UST T-530B (40,000-gallon capacity) leaked during its lifetime (1942–1992). This leaking released an unknown volume of waste liquids into the subsurface. Migration of the released liquids was probably not affected greatly by precipitation, and its volume over many years was the driving force allowing it to extend all the way to the water table (over 160 feet bgs). Specific chemicals present in groundwater at CAOC 9.60 and their tendency to migrate in soil and groundwater are discussed in Attachment A.

In the case of CAOC 10.38/10.39 Unit 7, it appears that waste liquids were released directly to the ground surface near the drainages in the area. This practice continuing over many years, resulted in the contaminants (VOCs) extending to the water table below Unit 7. Runoff at this CAOC may have aided the transport of contaminants away from the areas to which they were released and served to dilute their concentrations. Attachment E discusses the specific chemicals present in groundwater at Unit 7 and their tendency to migrate in soil and groundwater.

5.3.3 Surface Water Transport

Surface water transport is considered a viable transport pathway at all of the OU 7 CAOCs because surface soil is exposed (except at CAOC 10.38/10.39 Units 1 through 6 where contaminants were not released to the ground surface). The presence of surface structures and/or pavement on portions of CAOCs 10.27, 10.35, 10.37, and 10.38/10.39, however, tends to reduce the potential for the release of contaminants via surface water transport because less of the surface soil is exposed to runoff. In addition, the low average annual rainfall coupled with high average annual evapotranspiration rates is expected to result in low average annual runoff, and therefore a limited potential for surface water transport of contaminants most of the time. Intense desert thunderstorms can result in significant volumes of surface water runoff over a short period; however,

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these storms are infrequent locally. Surface water transport at the CAOCs with exposed soil during these storm events is expected to be brief.

5.4 SUMMARY OF FATE AND TRANSPORT

The prevailing climatic conditions in the local area provide the following viable transport mechanisms for migration of contaminants at the OU 7 CAOCs:

- atmospheric transport of vapors and fugitive dust
- surface water runoff and transport of contaminated soils and sediment
- at CAOC 9.60 and 10.38/10.39 Unit 7, transport of VOCs to groundwater and subsequent lateral movement in the direction of groundwater flow

These transport mechanisms are somewhat mitigated by the following factors:

- relatively low concentrations of contaminants present in soil
- depth at which contaminants are present (generally not present in surficial soil)
- low average annual rainfall coupled with high evapotranspiration rates
- presence of surface cover at several of the CAOCs

Transport of VOCs to groundwater and subsequent lateral movement in the direction of groundwater flow is a viable transport mechanism at CAOCs 9.60 and 10.38/10.39 (Unit 7).

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Table 5-1
Chemicals Reported in Soil Gas at CAOC 9.60*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	86	13	33 UG/L
1,1,2,2-TETRACHLOROETHANE	79-34-5	86	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	77	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	86	0	NA
1,1-DICHLOROETHANE	75-34-3	86	1	9.3 PPBV
1,1-DICHLOROETHENE	75-35-4	86	1	48 PPBV
1,2,3-TRICHLOROPROPANE	96-18-4	1	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	77	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	77	8	21 UG/L
1,2-DIBROMOETHANE	106-93-4	77	0	NA
1,2-DICHLOROBENZENE	95-50-1	76	0	NA
1,2-DICHLOROETHANE	107-06-2	86	0	NA
1,2-DICHLOROETHYLENE	540-59-0	9	0	NA
1,2-DICHLOROPROPANE	78-87-5	86	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	1	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	77	5	10 UG/L
1,3-DICHLOROBENZENE	541-73-1	76	0	NA
1,4-DICHLOROBENZENE	106-46-7	76	0	NA
2-BUTANONE	78-93-3	19	0	NA
2-HEXANONE	591-78-6	85	0	NA
4-METHYL-2-PENTANONE	108-10-1	85	0	NA
ACETONE	67-64-1	25	2	13 UG/L
BENZENE	71-43-2	86	0	NA
BENZYL CHLORIDE	100-44-7	1	0	NA
BROMODICHLOROMETHANE	75-27-4	86	0	NA
BROMOFORM	75-25-2	86	0	NA
BROMOMETHANE	74-83-9	86	1	1 UG/L
CARBON DISULFIDE	75-15-0	85	0	NA
CARBON TETRACHLORIDE	56-23-5	86	0	NA
CHLOROBENZENE	108-90-7	86	0	NA
CHLOROETHANE	75-00-3	86	0	NA
CHLOROFORM	67-66-3	86	1	6.4 PPBV
CHLOROMETHANE	74-87-3	86	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	77	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	86	0	NA
DBCP	96-12-8	76	0	NA
DIBROMOCHLOROMETHANE	124-48-1	86	0	NA
DIBROMOMETHANE	74-95-3	1	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	77	0	NA
ETHYLBENZENE	100-41-4	86	3	8.5 UG/L
HEXACHLOROBUTADIENE	87-68-3	77	0	NA
M,P-XYLENE	7816-60-0	76	23	52 UG/L
M-XYLENE	108-38-3	1	1	4 PPBV
METHYL TERT-BUTYL ETHER	1634-04-4	85	0	NA
METHYLENE CHLORIDE	75-09-2	86	1	0.2 PPMV
NAPHTHALENE	91-20-3	77	0	NA
O-XYLENE	95-47-6	77	7	22 UG/L
STYRENE	100-42-5	86	0	NA

Table 5-1
Chemicals Reported in Soil Gas at CAOC 9.60*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
TETRACHLOROETHENE	127-18-4	87	44	280 UG/L
TOLUENE	108-88-3	86	32	7 UG/L
TOTAL XYLENES	1330-20-7	9	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	77	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	86	0	NA
TRICHLOROETHYLENE	79-01-6	86	1	3.2 PPBV
TRICHLOROFLUOROMETHANE	75-69-4	77	0	NA
VINYL CHLORIDE	75-01-4	86	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-2
Chemicals Reported in Soil at CAOC 9.60^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Fuels				
DIESEL	11-84-7	82	20	45000000 UG/KG
GASOLINE RANGE ORGANICS	8006-61-9	9	2	1 MG/KG
JP-4 (JET PROPULSION FUEL #4)	50815-00-4	76	0	NA
MOTOR OIL	68476-77-7	82	30	2700 MG/KG
PETROLEUM HYDROCARBONS	10-90-2	4	2	11579 MG/KG
Metals				
ALUMINUM	7429-90-5	9	9	5570 MG/KG
ANTIMONY	7440-36-0	13	0	NA
ARSENIC	7440-38-2	13	9	3.1 MG/KG
BARIUM	7440-39-3	13	7	73.3 MG/KG
BERYLLIUM	7440-41-7	13	0	NA
CADMIUM	7440-43-9	13	1	5.4 MG/KG
CHROMIUM	7440-47-3	13	9	12.7 MG/KG
COBALT	7440-48-4	13	9	3.9 MG/KG
COPPER	7440-50-8	13	4	8.3 MG/KG
LEAD	7439-92-1	13	9	9.9 MG/KG
MANGANESE	7439-96-5	9	9	133 MG/KG
MERCURY	7439-97-6	13	0	NA
MOLYBDENUM	7439-98-7	4	0	NA
NICKEL	7440-02-0	13	9	4.3 MG/KG
SELENIUM	7782-49-2	13	0	NA
SILVER	7440-22-4	13	0	NA
THALLIUM	7440-28-0	13	0	NA
VANADIUM	7440-62-2	13	11	27.8 MG/KG
ZINC	7440-66-6	13	11	38.6 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	4	0	NA
4,4'-DDE	72-55-9	4	1	0.64 UG/KG
4,4'-DDT	50-29-3	4	1	6.66 UG/KG
ALDRIN	309-00-2	4	0	NA
ALPHA-BHC	319-84-6	4	0	NA
ALPHA-CHLORDANE	5103-71-9	4	0	NA
BETA-BHC	319-85-7	4	0	NA
DELTA-BHC	319-86-8	4	1	3.17 UG/KG
DIELDRIN	60-57-1	4	1	1.97 UG/KG
ENDOSULFAN SULFATE	1031-07-8	4	1	3.47 UG/KG
ENDOSULFAN-I	959-98-8	4	0	NA
ENDOSULFAN-II	33213-65-9	4	0	NA
ENDRIN	72-20-8	4	1	6.77 UG/KG
ENDRIN ALDEHYDE	7421-93-4	4	1	5.17 UG/KG
ENDRIN KETONE	53494-70-5	4	0	NA
GAMMA-BHC (LINDANE)	58-89-9	4	0	NA
GAMMA-CHLORDANE	5566-34-7	4	0	NA
HEPTACHLOR	76-44-8	4	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	4	0	NA
METHOXYCHLOR	72-43-5	4	1	4.73 UG/KG
AROCLOR 1016	12674-11-2	4	0	NA
AROCLOR 1221	11104-28-2	4	0	NA

Table 5-2
Chemicals Reported in Soil at CAOC 9.60^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1232	11141-16-5	4	0	NA
AROCLOR 1242	53469-21-9	4	0	NA
AROCLOR 1248	12672-29-6	4	0	NA
AROCLOR 1254	11097-69-1	4	0	NA
AROCLOR 1260	11096-82-5	4	0	NA
TOXAPHENE	8001-35-2	4	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	77	0	NA
1,2-DICHLOROBENZENE	95-50-1	78	0	NA
1,3-DICHLOROBENZENE	541-73-1	78	0	NA
1,4-DICHLOROBENZENE	106-46-7	78	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	78	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	78	0	NA
2,4-DICHLOROPHENOL	120-83-2	77	0	NA
2,4-DIMETHYLPHENOL	105-67-9	78	0	NA
2,4-DINITROPHENOL	51-28-5	79	1	698 UG/KG
2,4-DINITROTOLUENE	121-14-2	79	1	52 UG/KG
2,6-DINITROTOLUENE	606-20-2	78	0	NA
2-CHLORONAPHTHALENE	91-58-7	77	0	NA
2-CHLOROPHENOL	95-57-8	78	0	NA
2-METHYLNAPHTHALENE	91-57-6	79	2	4.6 MG/KG
2-METHYLPHENOL	95-48-7	78	0	NA
2-NITROANILINE	88-74-4	78	0	NA
2-NITROPHENOL	88-75-5	78	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	78	0	NA
3-NITROANILINE	99-09-2	78	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	78	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	78	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	78	0	NA
4-CHLOROANILINE	106-47-8	78	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	77	0	NA
4-METHYLPHENOL	106-44-5	78	0	NA
4-NITROANILINE	100-01-6	78	0	NA
4-NITROPHENOL	100-02-7	78	0	NA
ACENAPHTHENE	83-32-9	77	0	NA
ACENAPHTHYLENE	208-96-8	78	0	NA
ANTHRACENE	120-12-7	79	1	103 UG/KG
BENZO(A)ANTHRACENE	56-55-3	78	0	NA
BENZO(A)PYRENE	50-32-8	78	0	NA
BENZO(B)FLUORANTHENE	205-99-2	78	0	NA
BENZO(GHI)PERYLENE	191-24-2	78	0	NA
BENZO(K)FLUORANTHENE	207-08-9	78	0	NA
BENZOIC ACID	65-85-0	73	0	NA
BENZYL ALCOHOL	100-51-6	73	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	78	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	78	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	78	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	78	11	0.61 MG/KG
BUTYL BENZYL PHTHALATE	85-68-7	78	0	NA

Table 5-2
Chemicals Reported in Soil at CAOC 9.60^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CARBAZOLE	86-74-8	5	0	NA
CHRYSENE	218-01-9	77	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	78	0	NA
DI-N-OCTYL PHTHALATE	117-84-0	78	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	78	0	NA
DIBENZOFURAN	132-64-9	78	0	NA
DIETHYL PHTHALATE	84-66-2	78	3	0.46 MG/KG
DIMETHYL PHTHALATE	131-11-3	78	0	NA
FLUORANTHENE	206-44-0	78	0	NA
FLUORENE	86-73-7	78	1	50 UG/KG
HEXACHLOROBENZENE	118-74-1	78	0	NA
HEXACHLOROBUTADIENE	87-68-3	78	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	78	0	NA
HEXACHLOROETHANE	67-72-1	78	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	78	0	NA
ISOPHORONE	78-59-1	78	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	78	2	3419 UG/KG
N-NITROSODIPHENYLAMINE	86-30-6	79	1	39 UG/KG
NAPHTHALENE	91-20-3	77	0	NA
NITROBENZENE	98-95-3	78	0	NA
PENTACHLOROPHENOL	87-86-5	76	1	150 UG/KG
PHENANTHRENE	85-01-8	78	1	101 UG/KG
PHENOL	108-95-2	78	0	NA
PYRENE	129-00-0	78	0	NA
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	5	2	153 UG/KG
1,1,2,2-TETRACHLOROETHANE	79-34-5	3	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	4	0	NA
1,1-DICHLOROETHANE	75-34-3	4	0	NA
1,1-DICHLOROETHENE	75-35-4	4	0	NA
1,2-DICHLOROETHANE	107-06-2	4	0	NA
1,2-DICHLOROETHYLENE	540-59-0	4	0	NA
1,2-DICHLOROPROPANE	78-87-5	4	0	NA
2-BUTANONE	78-93-3	5	1	634 UG/KG
2-HEXANONE	591-78-6	4	1	386 UG/KG
4-METHYL-2-PENTANONE	108-10-1	3	0	NA
ACETONE	67-64-1	4	3	30 UG/KG
BENZENE	71-43-2	4	0	NA
BROMODICHLOROMETHANE	75-27-4	4	0	NA
BROMOFORM	75-25-2	4	0	NA
BROMOMETHANE	74-83-9	4	0	NA
CARBON DISULFIDE	75-15-0	4	0	NA
CARBON TETRACHLORIDE	56-23-5	4	0	NA
CHLOROBENZENE	108-90-7	3	0	NA
CHLOROETHANE	75-00-3	4	0	NA
CHLOROFORM	67-66-3	4	0	NA
CHLOROMETHANE	74-87-3	4	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	4	0	NA
DIBROMOCHLOROMETHANE	124-48-1	4	0	NA

Table 5-2
Chemicals Reported in Soil at CAOC 9.60^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
ETHYLBENZENE	100-41-4	4	3	4 UG/KG
METHYL TERT-BUTYL ETHER	1634-04-4	1	0	NA
METHYLENE CHLORIDE	75-09-2	4	0	NA
STYRENE	100-42-5	3	0	NA
TETRACHLOROETHENE	127-18-4	5	2	10107 UG/KG
TOLUENE	108-88-3	4	1	200 UG/KG
TOTAL XYLENES	1330-20-7	5	4	3751 UG/KG
TRANS-1,3-DICHLOROPROPENE	10061-02-6	4	0	NA
TRICHLOROETHYLENE	79-01-6	4	2	2 UG/KG
VINYL CHLORIDE	75-01-4	4	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-3
Chemicals Reported in Groundwater at CAOC 9.60*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Fuels				
DIESEL	11-84-7	4	2	1.5 MG/KG
GASOLINE RANGE ORGANICS	8006-61-9	3	0	NA
JP-4 (JET PROPULSION FUEL #4)	50815-00-4	3	0	NA
MOTOR OIL	68476-77-7	4	1	0.24 MG/KG
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	4	0	NA
1,2-DICHLOROBENZENE	95-50-1	4	0	NA
1,3-DICHLOROBENZENE	541-73-1	4	0	NA
1,4-DICHLOROBENZENE	106-46-7	4	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	4	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	4	0	NA
2,4-DICHLOROPHENOL	120-83-2	4	0	NA
2,4-DIMETHYLPHENOL	105-67-9	4	0	NA
2,4-DINITROPHENOL	51-28-5	4	0	NA
2,4-DINITROTOLUENE	121-14-2	4	0	NA
2,6-DINITROTOLUENE	606-20-2	4	0	NA
2-CHLORONAPHTHALENE	91-58-7	4	0	NA
2-CHLOROPHENOL	95-57-8	4	0	NA
2-METHYLNAPHTHALENE	91-57-6	4	0	NA
2-METHYLPHENOL	95-48-7	4	0	NA
2-NITROANILINE	88-74-4	4	0	NA
2-NITROPHENOL	88-75-5	4	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	4	0	NA
3-NITROANILINE	99-09-2	4	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	4	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	4	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	4	0	NA
4-CHLOROANILINE	106-47-8	4	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	4	0	NA
4-METHYLPHENOL	106-44-5	4	0	NA
4-NITROANILINE	100-01-6	4	0	NA
4-NITROPHENOL	100-02-7	4	0	NA
ACENAPHTHENE	83-32-9	4	0	NA
ACENAPHTHYLENE	208-96-8	4	0	NA
ANTHRACENE	120-12-7	4	0	NA
BENZO(A)ANTHRACENE	56-55-3	4	0	NA
BENZO(A)PYRENE	50-32-8	4	0	NA
BENZO(B)FLUORANTHENE	205-99-2	4	0	NA
BENZO(GH)PERYLENE	191-24-2	4	0	NA
BENZO(K)FLUORANTHENE	207-08-9	4	0	NA
BENZOIC ACID	65-85-0	4	0	NA
BENZYL ALCOHOL	100-51-6	4	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	4	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	4	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	4	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	4	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	4	0	NA
CHRYSENE	218-01-9	4	0	NA

Table 5-3
Chemicals Reported in Groundwater at CAOC 9.60*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
DI-N-BUTYL PHTHALATE	84-74-2	4	0	NA
DI-N-OCTYL PHTHALATE	117-84-0	4	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	4	0	NA
DIBENZOFURAN	132-64-9	4	0	NA
DIETHYL PHTHALATE	84-66-2	4	0	NA
DIMETHYL PHTHALATE	131-11-3	4	0	NA
FLUORANTHENE	206-44-0	4	0	NA
FLUORENE	86-73-7	4	0	NA
HEXACHLOROBENZENE	118-74-1	4	0	NA
HEXACHLOROBUTADIENE	87-68-3	4	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	4	0	NA
HEXACHLOROETHANE	67-72-1	4	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	4	0	NA
ISOPHORONE	78-59-1	4	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	4	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	4	0	NA
NAPHTHALENE	91-20-3	4	0	NA
NITROBENZENE	98-95-3	4	0	NA
PENTACHLOROPHENOL	87-86-5	4	0	NA
PHENANTHRENE	85-01-8	4	0	NA
PHENOL	108-95-2	4	0	NA
PYRENE	129-00-0	4	0	NA
Volatile Organic Compounds				
1,1,1,2-TETRACHLOROETHANE	630-20-6	4	0	NA
1,1,1-TRICHLOROETHANE	71-55-6	6	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	6	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	6	0	NA
1,1-DICHLOROETHANE	75-34-3	6	0	NA
1,1-DICHLOROETHENE	75-35-4	6	0	NA
1,1-DICHLOROPROPENE	563-58-6	4	0	NA
1,2,3-TRICHLOROBENZENE	87-61-6	4	0	NA
1,2,3-TRICHLOROPROPANE	96-18-4	4	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	4	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	4	0	NA
1,2-DIBROMOETHANE	106-93-4	4	0	NA
1,2-DICHLOROBENZENE	95-50-1	4	0	NA
1,2-DICHLOROETHANE	107-06-2	6	0	NA
1,2-DICHLOROETHYLENE	540-59-0	2	0	NA
1,2-DICHLOROPROPANE	78-87-5	6	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	4	0	NA
1,3-DICHLOROBENZENE	541-73-1	4	0	NA
1,3-DICHLOROPROPANE	142-28-9	4	0	NA
1,4-DICHLOROBENZENE	106-46-7	4	0	NA
1-CHLOROHEXANE	544-10-5	4	0	NA
2-HEXANONE	591-78-6	2	0	NA
4-METHYL-2-PENTANONE	108-10-1	2	0	NA
BENZENE	71-43-2	6	0	NA
BROMOBENZENE	108-86-1	4	0	NA
BROMOCHLOROMETHANE	74-97-5	4	0	NA

Table 5-3
Chemicals Reported in Groundwater at CAOC 9.60*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BROMODICHLOROMETHANE	75-27-4	6	0	NA
BROMOFORM	75-25-2	6	0	NA
BROMOMETHANE	74-83-9	6	0	NA
CARBON DISULFIDE	75-15-0	2	0	NA
CARBON TETRACHLORIDE	56-23-5	6	0	NA
CHLOROBENZENE	108-90-7	6	0	NA
CHLOROETHANE	75-00-3	6	0	NA
CHLOROFORM	67-66-3	6	4	1.2 UG/KG
CHLOROMETHANE	74-87-3	6	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	4	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	6	0	NA
CUMENE	98-82-8	4	0	NA
DBCP	96-12-8	4	0	NA
DIBROMOCHLOROMETHANE	124-48-1	6	0	NA
DIBROMOMETHANE	74-95-3	4	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	4	0	NA
ETHYLBENZENE	100-41-4	6	0	NA
HEXACHLOROBUTADIENE	87-68-3	4	0	NA
M,P-XYLENE	7816-60-0	4	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	2	0	NA
METHYLENE CHLORIDE	75-09-2	6	0	NA
N-BUTYLBENZENE	104-51-8	4	0	NA
N-PROPYLBENZENE	103-65-1	4	0	NA
NAPHTHALENE	91-20-3	4	0	NA
O-CHLOROTOLUENE	95-49-8	4	0	NA
O-XYLENE	95-47-6	4	0	NA
P-CHLOROTOLUENE	106-43-4	4	0	NA
P-CYMENE	99-87-6	4	0	NA
SEC-BUTYLBENZENE	135-98-8	4	0	NA
SEC-DICHLOROPROPANE	594-20-7	4	0	NA
STYRENE	100-42-5	6	0	NA
TERT-BUTYLBENZENE	98-06-6	4	0	NA
TETRACHLOROETHENE	127-18-4	6	4	0.8 UG/KG
TOLUENE	108-88-3	6	1	0.41 UG/KG
TOTAL XYLENES	1330-20-7	2	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	4	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	6	0	NA
TRICHLOROETHYLENE	79-01-6	6	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	4	0	NA
VINYL CHLORIDE	75-01-4	6	0	NA

Table 5-3
Chemicals Reported in Groundwater at CAOC 9.60*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-4
Chemicals Reported in Soil at CAOC 10.27^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Dioxin/Furan				
1,2,3,4,6,7,8-HPCDD	35822-46-9	23	6	400 PG/G
1,2,3,4,6,7,8-HPCDF	67562-39-4	23	5	110 PG/G
1,2,3,4,7,8,9-HPCDF	55673-89-7	23	3	4.1 PG/G
1,2,3,4,7,8-HXCDD	39227-28-6	23	1	3.7 PG/G
1,2,3,4,7,8-HXCDF	70648-26-9	23	3	5.7 PG/G
1,2,3,6,7,8-HXCDD	57653-85-7	23	4	15 PG/G
1,2,3,6,7,8-HXCDF	57117-44-9	23	3	3.7 PG/G
1,2,3,7,8,9-HXCDD	19408-74-3	23	3	7.2 PG/G
1,2,3,7,8,9-HXCDF	72918-21-9	23	0	NA
1,2,3,7,8-PECDD	40321-76-4	23	0	NA
1,2,3,7,8-PECDF	57117-41-6	23	0	NA
2,3,4,6,7,8-HXCDF	60851-34-5	23	2	3.4 PG/G
2,3,4,7,8-PECDF	57117-31-4	23	0	NA
2,3,7,8-TCDF	51207-31-9	23	4	6.7 PG/G
HPCDD	37871-00-4	23	6	760 PG/G
HPCDF	38998-75-3	23	5	350 PG/G
HXCDD	34465-46-8	23	4	68 PG/G
HXCDF	55684-94-1	23	4	110 PG/G
OCDD	3268-87-9	23	11	4400 PG/G
OCDF	39001-02-0	23	5	410 PG/G
PECDD	36088-22-9	23	0	NA
PECDF	30402-15-4	23	4	34 PG/G
TCDD	1746-01-6	23	0	NA
TOTAL TCDD	41903-57-5	23	0	NA
TOTAL TCDF	55722-27-5	23	4	25 PG/G
Fuels				
DIESEL	11-84-7	18	4	21 MG/KG
GASOLINE RANGE ORGANICS	8006-61-9	3	0	NA
MOTOR OIL	68476-77-7	15	7	110 MG/KG
OTHER COMPONENTS		3	2	630000 UG/KG
Metals				
ALUMINUM	7429-90-5	18	18	26000 MG/KG
ANTIMONY	7440-36-0	18	1	2.8 MG/KG
ARSENIC	7440-38-2	18	18	21.7 MG/KG
BARIUM	7440-39-3	18	18	336 MG/KG
BERYLLIUM	7440-41-7	18	3	0.4 MG/KG
BORON	7440-42-8	3	2	23.7 MG/KG
CADMIUM	7440-43-9	18	5	4.5 MG/KG
CHROMIUM	7440-47-3	18	18	110 MG/KG
COBALT	7440-48-4	18	17	41.6 MG/KG
COPPER	7440-50-8	18	10	345 MG/KG
CYANIDES	57-12-5	3	1	3.4 MG/KG
LEAD	7439-92-1	41	41	1980 MG/KG
MANGANESE	7439-96-5	18	18	784 MG/KG
MERCURY	7439-97-6	18	2	4.2 MG/KG
MOLYBDENUM	7439-98-7	18	7	6.7 MG/KG
NICKEL	7440-02-0	18	16	54.7 MG/KG
SELENIUM	7782-49-2	18	3	1.3 MG/KG
SILVER	7440-22-4	18	1	1.6 MG/KG

Table 5-4
Chemicals Reported in Soil at CAOC 10.27^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
STRONTIUM	7440-24-6	3	3	77.1 MG/KG
THALLIUM	7440-28-0	18	0	NA
TRIOXIDE CHROMIUM	1333-82-0	15	0	NA
VANADIUM	7440-62-2	18	18	50 MG/KG
ZINC	7440-66-6	18	18	838 MG/KG
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	37	0	NA
1,2-DICHLOROBENZENE	95-50-1	37	0	NA
1,3-DICHLOROBENZENE	541-73-1	37	0	NA
1,4-DICHLOROBENZENE	106-46-7	37	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	37	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	37	0	NA
2,4-DICHLOROPHENOL	120-83-2	37	0	NA
2,4-DIMETHYLPHENOL	105-67-9	37	0	NA
2,4-DINITROPHENOL	51-28-5	37	0	NA
2,4-DINITROTOLUENE	121-14-2	37	0	NA
2,6-DINITROTOLUENE	606-20-2	37	0	NA
2-CHLORONAPHTHALENE	91-58-7	37	0	NA
2-CHLOROPHENOL	95-57-8	37	0	NA
2-METHYLNAPHTHALENE	91-57-6	37	1	120 UG/KG
2-METHYLPHENOL	95-48-7	37	0	NA
2-NITROANILINE	88-74-4	37	0	NA
2-NITROPHENOL	88-75-5	37	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	37	0	NA
3-NITROANILINE	99-09-2	37	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	37	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	37	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	37	0	NA
4-CHLOROANILINE	106-47-8	37	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	37	0	NA
4-METHYLPHENOL	106-44-5	37	0	NA
4-NITROANILINE	100-01-6	37	0	NA
4-NITROPHENOL	100-02-7	37	0	NA
ACENAPHTHENE	83-32-9	37	0	NA
ACENAPHTHYLENE	208-96-8	37	0	NA
ANTHRACENE	120-12-7	37	0	NA
BENZO(A)ANTHRACENE	56-55-3	37	3	0.55 MG/KG
BENZO(A)PYRENE	50-32-8	37	3	1.1 MG/KG
BENZO(B)FLUORANTHENE	205-99-2	37	4	0.68 MG/KG
BENZO(GHI)PERYLENE	191-24-2	37	2	0.73 MG/KG
BENZO(K)FLUORANTHENE	207-08-9	37	3	0.81 MG/KG
BENZOIC ACID	65-85-0	19	0	NA
BENZYL ALCOHOL	100-51-6	19	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	37	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	37	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	37	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	37	2	0.45 MG/KG
BUTYL BENZYL PHTHALATE	85-68-7	37	1	25 UG/KG
CARBAZOLE	86-74-8	18	0	NA
CHRYSENE	218-01-9	37	4	0.86 MG/KG

Table 5-4
Chemicals Reported in Soil at CAOC 10.27^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
DI-N-BUTYL PHTHALATE	84-74-2	37	0	NA
DI-N-OCTYL PHTHALATE	117-84-0	37	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	37	1	75 UG/KG
DIBENZOFURAN	132-64-9	37	1	74 UG/KG
DIETHYL PHTHALATE	84-66-2	37	0	NA
DIMETHYL PHTHALATE	131-11-3	37	0	NA
FLUORANTHENE	206-44-0	37	3	2.1 MG/KG
FLUORENE	86-73-7	37	0	NA
HEXACHLOROBENZENE	118-74-1	37	0	NA
HEXACHLOROBUTADIENE	87-68-3	37	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	37	0	NA
HEXACHLOROETHANE	67-72-1	37	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	37	2	0.72 MG/KG
ISOPHORONE	78-59-1	37	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	37	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	37	0	NA
NAPHTHALENE	91-20-3	37	1	150 UG/KG
NITROBENZENE	98-95-3	37	0	NA
PENTACHLOROPHENOL	87-86-5	37	0	NA
PHENANTHRENE	85-01-8	37	2	0.52 MG/KG
PHENOL	108-95-2	37	0	NA
PYRENE	129-00-0	37	3	1.6 MG/KG

Table 5-4
Chemicals Reported in Soil at CAOC 10.27^{a,b}

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

BHC – benzene hexachloride
 CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
 CAS – Chemical Abstracts Service
 2,4-D – (2,4-dichlorophenoxy)-acetic acid
 2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
 DBCP – 1,2-dibromo-3-chloropropane
 DDD – dichlorodiphenyldichloroethane
 DDE – dichlorodiphenyldichloroethene
 DDT – dichlorodiphenyltrichloroethane
 HPCDD – heptachlorodibenzo-p-dioxins
 HPCDF – heptachlorodibenzofurans
 HXCDD – hexachlorodibenzo-p-dioxins
 HXCDF – hexachlorodibenzofurans
 UG/KG – micrograms per kilogram
 UG/L – micrograms per liter
 MCPA – 2-methyl-4-chlorophenoxyacetic acid
 MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
 MG/KG – milligrams per kilogram
 NA – not applicable
 OCDD – octachlorodibenzo-p-dioxins
 OCDF – octachlorodibenzofurans
 PCB – polychlorinated biphenyl
 PECDD – pentachlorodibenzo-p-dioxins
 PECDF – pentachlorodibenzofurans
 PG/G – picograms per gram
 PPBV – parts per billion per volume
 PPMV – parts per million per volume
 2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
 TCDD – tetrachlorodibenzo-p-dioxins
 TCDF – tetrachlorodibenzofurans
 2,4,5-TP – silvex acid

Table 5-5
Chemicals Reported in Groundwater at CAOC 10.27*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Metals				
LEAD	7439-92-1	1	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	4	0	NA
1,2-DICHLOROBENZENE	95-50-1	4	0	NA
1,3-DICHLOROBENZENE	541-73-1	4	0	NA
1,4-DICHLOROBENZENE	106-46-7	4	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	4	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	4	0	NA
2,4-DICHLOROPHENOL	120-83-2	4	0	NA
2,4-DIMETHYLPHENOL	105-67-9	4	0	NA
2,4-DINITROPHENOL	51-28-5	4	0	NA
2,4-DINITROTOLUENE	121-14-2	4	0	NA
2,6-DINITROTOLUENE	606-20-2	4	0	NA
2-CHLORONAPHTHALENE	91-58-7	4	0	NA
2-CHLOROPHENOL	95-57-8	4	0	NA
2-METHYLNAPHTHALENE	91-57-6	4	0	NA
2-METHYLPHENOL	95-48-7	4	0	NA
2-NITROANILINE	88-74-4	4	0	NA
2-NITROPHENOL	88-75-5	4	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	4	0	NA
3-NITROANILINE	99-09-2	4	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	4	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	4	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	4	0	NA
4-CHLOROANILINE	106-47-8	4	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	4	0	NA
4-METHYLPHENOL	106-44-5	4	0	NA
4-NITROANILINE	100-01-6	4	0	NA
4-NITROPHENOL	100-02-7	4	0	NA
ACENAPHTHENE	83-32-9	4	0	NA
ACENAPHTHYLENE	208-96-8	4	0	NA
ANTHRACENE	120-12-7	4	0	NA
BENZO(A)ANTHRACENE	56-55-3	4	0	NA
BENZO(A)PYRENE	50-32-8	4	0	NA
BENZO(B)FLUORANTHENE	205-99-2	4	0	NA
BENZO(GH)PERYLENE	191-24-2	4	0	NA
BENZO(K)FLUORANTHENE	207-08-9	4	0	NA
BENZOIC ACID	65-85-0	1	0	NA
BENZYL ALCOHOL	100-51-6	1	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	4	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	4	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	4	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	4	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	4	0	NA
CARBAZOLE	86-74-8	3	0	NA
CHRYSENE	218-01-9	4	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	4	1	7.7 UG/L
DI-N-OCTYL PHTHALATE	117-84-0	4	0	NA

Table 5-5
Chemicals Reported in Groundwater at CAOC 10.27*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
DIBENZ(A,H)ANTHRACENE	53-70-3	4	0	NA
DIBENZOFURAN	132-64-9	4	0	NA
DIETHYL PHTHALATE	84-66-2	4	1	13 UG/L
DIMETHYL PHTHALATE	131-11-3	4	0	NA
FLUORANTHENE	206-44-0	4	0	NA
FLUORENE	86-73-7	4	0	NA
HEXACHLOROBENZENE	118-74-1	4	0	NA
HEXACHLOROBUTADIENE	87-68-3	4	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	4	0	NA
HEXACHLOROETHANE	67-72-1	4	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	4	0	NA
ISOPHORONE	78-59-1	4	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	4	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	4	0	NA
NAPHTHALENE	91-20-3	4	0	NA
NITROBENZENE	98-95-3	4	0	NA
PENTACHLOROPHENOL	87-86-5	4	0	NA
PHENANTHRENE	85-01-8	4	0	NA
PHENOL	108-95-2	4	0	NA
PYRENE	129-00-0	4	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-6
Chemicals Reported in Soil at CAOC 10.35^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Fuels				
DIESEL	11-84-7	6	0	NA
Metals				
ALUMINUM	7429-90-5	14	14	15600 MG/KG
ANTIMONY	7440-36-0	14	0	NA
ARSENIC	7440-38-2	14	14	8.6 MG/KG
BARIUM	7440-39-3	14	14	182 MG/KG
BERYLLIUM	7440-41-7	14	8	0.7 MG/KG
BORON	7440-42-8	6	6	15 MG/KG
CADMIUM	7440-43-9	14	0	NA
CHROMIUM	7440-47-3	14	14	18.4 MG/KG
COBALT	7440-48-4	14	14	9.5 MG/KG
COPPER	7440-50-8	14	14	17.4 MG/KG
CYANIDES	57-12-5	6	0	NA
LEAD	7439-92-1	14	14	50.1 MG/KG
MANGANESE	7439-96-5	14	14	489 MG/KG
MERCURY	7439-97-6	14	1	0.15 MG/KG
MOLYBDENUM	7439-98-7	6	0	NA
NICKEL	7440-02-0	14	14	13.8 MG/KG
SELENIUM	7782-49-2	14	1	1.1 MG/KG
SILVER	7440-22-4	14	0	NA
STRONTIUM	7440-24-6	6	6	222 MG/KG
THALLIUM	7440-28-0	14	0	NA
VANADIUM	7440-62-2	14	14	42.8 MG/KG
ZINC	7440-66-6	14	14	76.7 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	25	0	NA
4,4'-DDE	72-55-9	25	0	NA
4,4'-DDT	50-29-3	25	0	NA
ALDRIN	309-00-2	25	2	2.22 UG/KG
ALPHA-BHC	319-84-6	25	0	NA
ALPHA-CHLORDANE	5103-71-9	25	6	24.93 UG/KG
BETA-BHC	319-85-7	25	1	1.04 UG/KG
DELTA-BHC	319-86-8	25	0	NA
DIELDRIN	60-57-1	25	6	72.32 UG/KG
ENDOSULFAN SULFATE	1031-07-8	25	6	76.64 UG/KG
ENDOSULFAN-I	959-98-8	25	1	0.45 UG/KG
ENDOSULFAN-II	33213-65-9	25	6	152.8 UG/KG
ENDRIN	72-20-8	25	6	49.18 UG/KG
ENDRIN ALDEHYDE	7421-93-4	25	6	275.92 UG/KG
ENDRIN KETONE	53494-70-5	25	5	217.39 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	25	1	0.6 UG/KG
GAMMA-CHLORDANE	5566-34-7	25	6	20.82 UG/KG
HEPTACHLOR	76-44-8	25	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	25	1	0.58 UG/KG
METHOXYCHLOR	72-43-5	25	0	NA
AROCLOR 1016	12674-11-2	52	0	NA
AROCLOR 1221	11104-28-2	52	0	NA
AROCLOR 1232	11141-16-5	52	0	NA

Table 5-6
Chemicals Reported in Soil at CAOC 10.35^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1242	53469-21-9	52	0	NA
AROCLOR 1248	12672-29-6	52	0	NA
AROCLOR 1254	11097-69-1	52	0	NA
AROCLOR 1260	11096-82-5	52	11	3687.28 UG/KG
TOXAPHENE	8001-35-2	25	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	22	0	NA
1,2-DICHLOROBENZENE	95-50-1	22	0	NA
1,3-DICHLOROBENZENE	541-73-1	22	0	NA
1,4-DICHLOROBENZENE	106-46-7	22	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	22	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	22	0	NA
2,4-DICHLOROPHENOL	120-83-2	22	0	NA
2,4-DIMETHYLPHENOL	105-67-9	22	0	NA
2,4-DINITROPHENOL	51-28-5	22	0	NA
2,4-DINITROTOLUENE	121-14-2	22	0	NA
2,6-DINITROTOLUENE	606-20-2	22	0	NA
2-CHLORONAPHTHALENE	91-58-7	22	0	NA
2-CHLOROPHENOL	95-57-8	22	0	NA
2-METHYLNAPHTHALENE	91-57-6	22	0	NA
2-METHYLPHENOL	95-48-7	22	0	NA
2-NITROANILINE	88-74-4	22	0	NA
2-NITROPHENOL	88-75-5	22	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	22	0	NA
3-NITROANILINE	99-09-2	22	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	6	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	22	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	22	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	22	0	NA
4-CHLOROANILINE	106-47-8	22	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	22	0	NA
4-METHYLPHENOL	106-44-5	22	0	NA
4-NITROANILINE	100-01-6	22	0	NA
4-NITROPHENOL	100-02-7	22	0	NA
ACENAPHTHENE	83-32-9	22	0	NA
ACENAPHTHYLENE	208-96-8	22	0	NA
ANILINE	62-53-3	6	0	NA
ANTHRACENE	120-12-7	22	0	NA
BENZO(A)ANTHRACENE	56-55-3	22	0	NA
BENZO(A)PYRENE	50-32-8	22	0	NA
BENZO(B)FLUORANTHENE	205-99-2	22	0	NA
BENZO(GHI)PERYLENE	191-24-2	22	0	NA
BENZO(K)FLUORANTHENE	207-08-9	8	0	NA
BENZOIC ACID	65-85-0	16	0	NA
BENZYL ALCOHOL	100-51-6	16	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	22	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	22	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	22	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	22	6	0.84 MG/KG

Table 5-6
Chemicals Reported in Soil at CAOC 10.35^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BISPHENOL A	80-05-7	6	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	22	0	NA
CARBAZOLE	86-74-8	6	0	NA
CHRYSENE	218-01-9	22	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	22	3	1713 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	22	1	1.6 MG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	22	0	NA
DIBENZOFURAN	132-64-9	22	0	NA
DIETHYL PHTHALATE	84-66-2	22	0	NA
DIMETHYL PHTHALATE	131-11-3	22	0	NA
FLUORANTHENE	206-44-0	22	0	NA
FLUORENE	86-73-7	22	0	NA
HEXACHLOROBENZENE	118-74-1	22	0	NA
HEXACHLOROBUTADIENE	87-68-3	22	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	22	0	NA
HEXACHLOROETHANE	67-72-1	22	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	22	0	NA
ISOPHORONE	78-59-1	22	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	22	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	22	0	NA
NAPHTHALENE	91-20-3	22	0	NA
NITROBENZENE	98-95-3	22	0	NA
PENTACHLOROPHENOL	87-86-5	22	0	NA
PHENANTHRENE	85-01-8	22	0	NA
PHENOL	108-95-2	22	0	NA
PYRENE	129-00-0	22	0	NA

Table 5-6
Chemicals Reported in Soil at CAOC 10.35^{a,b}

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-7
Chemicals Reported in Groundwater at CAOC 10.35^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Metals				
BARIUM	7440-39-3	1	1	33.6 UG/L
Pesticides/PCB				
4,4'-DDD	72-54-8	1	0	NA
4,4'-DDE	72-55-9	1	0	NA
4,4'-DDT	50-29-3	1	1	0.28 UG/L
ALDRIN	309-00-2	1	0	NA
ALPHA-BHC	319-84-6	1	0	NA
ALPHA-CHLORDANE	5103-71-9	1	0	NA
BETA-BHC	319-85-7	1	0	NA
DELTA-BHC	319-86-8	1	0	NA
DIELDRIN	60-57-1	1	0	NA
ENDOSULFAN SULFATE	1031-07-8	1	0	NA
ENDOSULFAN-I	959-98-8	1	0	NA
ENDOSULFAN-II	33213-65-9	1	0	NA
ENDRIN	72-20-8	1	0	NA
ENDRIN ALDEHYDE	7421-93-4	1	0	NA
ENDRIN KETONE	53494-70-5	1	0	NA
GAMMA-BHC (LINDANE)	58-89-9	1	0	NA
GAMMA-CHLORDANE	5566-34-7	1	0	NA
HEPTACHLOR	76-44-8	1	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	1	0	NA
METHOXYCHLOR	72-43-5	1	0	NA
AROCLOR 1016	12674-11-2	1	0	NA
AROCLOR 1221	11104-28-2	1	0	NA
AROCLOR 1232	11141-16-5	1	0	NA
AROCLOR 1242	53469-21-9	1	0	NA
AROCLOR 1248	12672-29-6	1	0	NA
AROCLOR 1254	11097-69-1	1	0	NA
AROCLOR 1260	11096-82-5	1	0	NA
TOXAPHENE	8001-35-2	1	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	1	0	NA
1,2-DICHLOROBENZENE	95-50-1	1	0	NA
1,3-DICHLOROBENZENE	541-73-1	1	0	NA
1,4-DICHLOROBENZENE	106-46-7	1	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	1	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	1	0	NA
2,4-DICHLOROPHENOL	120-83-2	1	0	NA
2,4-DIMETHYLPHENOL	105-67-9	1	0	NA
2,4-DINITROPHENOL	51-28-5	1	0	NA
2,4-DINITROTOLUENE	121-14-2	1	0	NA
2,6-DINITROTOLUENE	606-20-2	1	0	NA
2-CHLORONAPHTHALENE	91-58-7	1	0	NA
2-CHLOROPHENOL	95-57-8	1	0	NA
2-METHYLNAPHTHALENE	91-57-6	1	0	NA
2-METHYLPHENOL	95-48-7	1	0	NA
2-NITROANILINE	88-74-4	1	0	NA
2-NITROPHENOL	88-75-5	1	0	NA

Table 5-7
Chemicals Reported in Groundwater at CAOC 10.35^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
3,3'-DICHLOROBENZIDINE	91-94-1	1	0	NA
3-NITROANILINE	99-09-2	1	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	1	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	1	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	1	0	NA
4-CHLOROANILINE	106-47-8	1	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	1	0	NA
4-METHYLPHENOL	106-44-5	1	0	NA
4-NITROANILINE	100-01-6	1	0	NA
4-NITROPHENOL	100-02-7	1	0	NA
ACENAPHTHENE	83-32-9	1	0	NA
ACENAPHTHYLENE	208-96-8	1	0	NA
ANTHRACENE	120-12-7	1	0	NA
BENZO(A)ANTHRACENE	56-55-3	1	0	NA
BENZO(A)PYRENE	50-32-8	1	0	NA
BENZO(B)FLUORANTHENE	205-99-2	1	0	NA
BENZO(GHI)PERYLENE	191-24-2	1	0	NA
BENZO(K)FLUORANTHENE	207-08-9	1	0	NA
BENZOIC ACID	65-85-0	1	0	NA
BENZYL ALCOHOL	100-51-6	1	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	1	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	1	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	1	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	1	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	1	0	NA
CHRYSENE	218-01-9	1	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	1	0	NA
DI-N-OCTYL PHTHALATE	117-84-0	1	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	1	0	NA
DIBENZOFURAN	132-64-9	1	0	NA
DIETHYL PHTHALATE	84-66-2	1	0	NA
DIMETHYL PHTHALATE	131-11-3	1	0	NA
FLUORANTHENE	206-44-0	1	0	NA
FLUORENE	86-73-7	1	0	NA
HEXACHLOROBENZENE	118-74-1	1	0	NA
HEXACHLOROBUTADIENE	87-68-3	1	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	1	0	NA
HEXACHLOROETHANE	67-72-1	1	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	1	0	NA
ISOPHORONE	78-59-1	1	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	1	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	1	0	NA
NAPHTHALENE	91-20-3	1	0	NA
NITROBENZENE	98-95-3	1	0	NA
PENTACHLOROPHENOL	87-86-5	1	0	NA
PHENANTHRENE	85-01-8	1	0	NA
PHENOL	108-95-2	1	0	NA
PYRENE	129-00-0	1	0	NA

Table 5-7
Chemicals Reported in Groundwater at CAOC 10.35^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	4	0	NA
1,1,2,2-TETRACHLORODIFLUOROETHANE	76-12-0	3	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	4	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	4	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	4	0	NA
1,1-DICHLOROETHANE	75-34-3	4	0	NA
1,1-DICHLOROETHENE	75-35-4	4	0	NA
1,2-DICHLOROETHANE	107-06-2	5	1	0.7 UG/L
1,2-DICHLOROPROPANE	78-87-5	4	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	1	0	NA
2-BUTANONE	78-93-3	4	0	NA
2-HEXANONE	591-78-6	4	0	NA
4-METHYL-2-PENTANONE	108-10-1	4	0	NA
ACETONE	67-64-1	4	0	NA
BENZENE	71-43-2	4	0	NA
BROMODICHLOROMETHANE	75-27-4	4	0	NA
BROMOFORM	75-25-2	4	0	NA
BROMOMETHANE	74-83-9	4	0	NA
BUTANE, 2-METHOXY-2-METHYL-	994-05-8	1	0	NA
CARBON DISULFIDE	75-15-0	4	1	0.3 UG/L
CARBON TETRACHLORIDE	56-23-5	4	0	NA
CHLOROBENZENE	108-90-7	4	0	NA
CHLOROETHANE	75-00-3	4	0	NA
CHLOROFORM	67-66-3	4	0	NA
CHLOROMETHANE	74-87-3	4	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	4	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	4	0	NA
DIBROMOCHLOROMETHANE	124-48-1	4	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	4	0	NA
DIISOPROPYL ETHER	108-20-3	1	0	NA
ETHYLBENZENE	100-41-4	4	0	NA
ISOPROPANOL	67-63-0	4	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	4	0	NA
METHYLENE CHLORIDE	75-09-2	4	0	NA
PROPANE, 2-ETHOXY-2-METHYL-	637-92-3	1	0	NA
STYRENE	100-42-5	4	0	NA
TETRACHLOROETHENE	127-18-4	5	4	1 UG/L
TOLUENE	108-88-3	4	1	0.7 UG/L
TOTAL XYLENES	1330-20-7	4	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	4	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	4	0	NA
TRICHLOROETHYLENE	79-01-6	4	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	4	0	NA
VINYL CHLORIDE	75-01-4	4	0	NA

Table 5-7
Chemicals Reported in Groundwater at CAOC 10.35^{a,b}

Notes:

^a table does not include tentatively identified compounds

^b table only includes the last four quarters sampled for each location

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-8
Chemicals Reported in Soil Gas at CAOC 10.37*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	38	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	38	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	29	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	38	0	NA
1,1-DICHLOROETHANE	75-34-3	38	0	NA
1,1-DICHLOROETHENE	75-35-4	38	0	NA
1,2,3-TRICHLOROPROPANE	96-18-4	1	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	29	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	29	0	NA
1,2-DIBROMOETHANE	106-93-4	29	0	NA
1,2-DICHLOROBENZENE	95-50-1	28	0	NA
1,2-DICHLOROETHANE	107-06-2	38	0	NA
1,2-DICHLOROETHYLENE	540-59-0	9	0	NA
1,2-DICHLOROPROPANE	78-87-5	38	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	1	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	29	0	NA
1,3-DICHLOROBENZENE	541-73-1	28	0	NA
1,4-DICHLOROBENZENE	106-46-7	28	0	NA
2-BUTANONE	78-93-3	14	0	NA
2-HEXANONE	591-78-6	37	0	NA
4-METHYL-2-PENTANONE	108-10-1	37	0	NA
ACETONE	67-64-1	14	1	6.4 UG/L
BENZENE	71-43-2	38	0	NA
BENZYL CHLORIDE	100-44-7	1	0	NA
BROMODICHLOROMETHANE	75-27-4	38	0	NA
BROMOFORM	75-25-2	38	0	NA
BROMOMETHANE	74-83-9	38	0	NA
CARBON DISULFIDE	75-15-0	37	0	NA
CARBON TETRACHLORIDE	56-23-5	38	0	NA
CHLOROBENZENE	108-90-7	38	0	NA
CHLOROETHANE	75-00-3	38	0	NA
CHLOROFORM	67-66-3	38	4	29 UG/L
CHLOROMETHANE	74-87-3	38	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	29	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	38	0	NA
DBCP	96-12-8	28	0	NA
DIBROMOCHLOROMETHANE	124-48-1	38	0	NA
DIBROMOMETHANE	74-95-3	1	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	29	0	NA
ETHYLBENZENE	100-41-4	38	0	NA
HEXACHLOROBUTADIENE	87-68-3	29	0	NA
M,P-XYLENE	7816-60-0	28	3	1.7 UG/L
M-XYLENE	108-38-3	1	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	37	0	NA
METHYLENE CHLORIDE	75-09-2	38	0	NA
NAPHTHALENE	91-20-3	28	0	NA
O-XYLENE	95-47-6	29	1	0.58 UG/L
STYRENE	100-42-5	38	0	NA

Table 5-8
Chemicals Reported in Soil Gas at CAOC 10.37*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
TETRACHLOROETHENE	127-18-4	38	5	4560 PPBV
TOLUENE	108-88-3	38	5	0.84 UG/L
TOTAL XYLENES	1330-20-7	9	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	29	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	38	0	NA
TRICHLOROETHYLENE	79-01-6	38	1	4.3 PPBV
TRICHLOROFLUOROMETHANE	75-69-4	29	0	NA
VINYL CHLORIDE	75-01-4	38	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-9
Chemicals Reported in Soil at CAOC 10.37^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Fuels				
DIESEL	11-84-7	74	6	48000 UG/KG
JP-4 (JET PROPULSION FUEL #4)	50815-00-4	33	0	NA
MOTOR OIL	68476-77-7	70	18	160000 UG/KG
Metals				
ALUMINUM	7429-90-5	59	59	29100 MG/KG
ANTIMONY	7440-36-0	59	0	NA
ARSENIC	7440-38-2	59	47	16.3 MG/KG
BARIUM	7440-39-3	59	59	239 MG/KG
BERYLLIUM	7440-41-7	59	1	1.7 MG/KG
BORON	7440-42-8	26	21	117 MG/KG
CADMIUM	7440-43-9	59	0	NA
CHROMIUM	7440-47-3	59	59	193 MG/KG
COBALT	7440-48-4	59	50	36.6 MG/KG
COPPER	7440-50-8	59	42	86.7 MG/KG
CYANIDES	57-12-5	30	0	NA
HEXAVALENT CHROMIUM	18540-29-9	16	0	NA
LEAD	7439-92-1	59	59	22.6 MG/KG
MANGANESE	7439-96-5	59	59	1080 MG/KG
MERCURY	7439-97-6	59	4	0.086 MG/KG
MOLYBDENUM	7439-98-7	59	3	7.1 MG/KG
NICKEL	7440-02-0	59	39	588 MG/KG
SELENIUM	7782-49-2	59	4	0.33 MG/KG
SILVER	7440-22-4	59	15	14.4 MG/KG
STRONTIUM	7440-24-6	26	26	515 MG/KG
THALLIUM	7440-28-0	59	2	0.36 MG/KG
VANADIUM	7440-62-2	59	59	59.2 MG/KG
ZINC	7440-66-6	59	59	110 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	9	0	NA
4,4'-DDE	72-55-9	9	1	1.12 UG/KG
4,4'-DDT	50-29-3	9	1	0.32 UG/KG
ALDRIN	309-00-2	9	0	NA
ALPHA-BHC	319-84-6	9	2	0.35 UG/KG
ALPHA-CHLORDANE	5103-71-9	9	1	0.33 UG/KG
BETA-BHC	319-85-7	9	0	NA
DELTA-BHC	319-86-8	9	0	NA
DIELDRIN	60-57-1	9	2	0.26 UG/KG
ENDOSULFAN SULFATE	1031-07-8	9	0	NA
ENDOSULFAN-I	959-98-8	9	0	NA
ENDOSULFAN-II	33213-65-9	9	1	0.38 UG/KG
ENDRIN	72-20-8	9	0	NA
ENDRIN ALDEHYDE	7421-93-4	9	0	NA
ENDRIN KETONE	53494-70-5	9	1	0.39 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	9	1	0.44 UG/KG
GAMMA-CHLORDANE	5566-34-7	9	1	0.24 UG/KG
HEPTACHLOR	76-44-8	9	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	9	0	NA
METHOXYCHLOR	72-43-5	9	0	NA

Table 5-9
Chemicals Reported in Soil at CAOC 10.37^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1016	12674-11-2	15	0	NA
AROCLOR 1221	11104-28-2	15	0	NA
AROCLOR 1232	11141-16-5	15	0	NA
AROCLOR 1242	53469-21-9	15	0	NA
AROCLOR 1248	12672-29-6	15	0	NA
AROCLOR 1254	11097-69-1	15	0	NA
AROCLOR 1260	11096-82-5	15	0	NA
TOXAPHENE	8001-35-2	9	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	98	0	NA
1,2-DICHLOROBENZENE	95-50-1	98	0	NA
1,3-DICHLOROBENZENE	541-73-1	98	0	NA
1,4-DICHLOROBENZENE	106-46-7	98	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	98	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	98	0	NA
2,4-DICHLOROPHENOL	120-83-2	98	0	NA
2,4-DIMETHYLPHENOL	105-67-9	98	0	NA
2,4-DINITROPHENOL	51-28-5	98	0	NA
2,4-DINITROTOLUENE	121-14-2	98	0	NA
2,6-DINITROTOLUENE	606-20-2	98	0	NA
2-CHLORONAPHTHALENE	91-58-7	98	0	NA
2-CHLOROPHENOL	95-57-8	98	0	NA
2-METHYLNAPHTHALENE	91-57-6	98	1	42 UG/KG
2-METHYLPHENOL	95-48-7	98	0	NA
2-NITROANILINE	88-74-4	98	0	NA
2-NITROPHENOL	88-75-5	98	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	98	0	NA
3-NITROANILINE	99-09-2	98	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	19	1	1360 UG/KG
4,6-DINITRO-2-METHYLPHENOL	534-52-1	98	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	98	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	98	0	NA
4-CHLOROANILINE	106-47-8	98	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	98	0	NA
4-METHYLPHENOL	106-44-5	98	0	NA
4-NITROANILINE	100-01-6	98	0	NA
4-NITROPHENOL	100-02-7	97	0	NA
ACENAPHTHENE	83-32-9	98	5	2487 UG/KG
ACENAPHTHYLENE	208-96-8	98	0	NA
ANILINE	62-53-3	20	0	NA
ANTHRACENE	120-12-7	98	4	2122 UG/KG
BENZO(A)ANTHRACENE	56-55-3	98	8	17412 UG/KG
BENZO(A)PYRENE	50-32-8	98	11	14562 UG/KG
BENZO(B)FLUORANTHENE	205-99-2	98	12	14957 UG/KG
BENZO(GH)PERYLENE	191-24-2	98	9	11889 UG/KG
BENZO(K)FLUORANTHENE	207-08-9	98	9	7670 UG/KG
BENZOIC ACID	65-85-0	33	0	NA
BENZYL ALCOHOL	100-51-6	33	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	98	0	NA

Table 5-9
Chemicals Reported in Soil at CAOC 10.37^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BIS(2-CHLOROETHOXY)METHANE	111-91-1	98	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	98	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	98	36	1527 UG/KG
BISPHENOL A	80-05-7	20	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	98	2	591 UG/KG
CARBAZOLE	86-74-8	65	4	1818 UG/KG
CHRYSENE	218-01-9	98	10	15768 UG/KG
DI-N-BUTYL PHTHALATE	84-74-2	98	15	3744 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	98	1	40 UG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	98	5	1900 UG/KG
DIBENZOFURAN	132-64-9	98	1	50 UG/KG
DIETHYL PHTHALATE	84-66-2	98	0	NA
DIMETHYL PHTHALATE	131-11-3	98	0	NA
FLUORANTHENE	206-44-0	98	10	22773 UG/KG
FLUORENE	86-73-7	98	1	97 UG/KG
HEXACHLOROBENZENE	118-74-1	98	0	NA
HEXACHLOROBUTADIENE	87-68-3	98	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	98	0	NA
HEXACHLOROETHANE	67-72-1	98	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	98	8	14362 UG/KG
ISOPHORONE	78-59-1	98	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	98	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	98	0	NA
NAPHTHALENE	91-20-3	98	2	122 UG/KG
NITROBENZENE	98-95-3	98	0	NA
PENTACHLOROPHENOL	87-86-5	98	0	NA
PHENANTHRENE	85-01-8	98	11	9376 UG/KG
PHENOL	108-95-2	98	0	NA
PYRENE	129-00-0	98	10	24829 UG/KG
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	37	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	37	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	37	0	NA
1,1-DICHLOROETHANE	75-34-3	37	0	NA
1,1-DICHLOROETHENE	75-35-4	37	0	NA
1,2-DICHLOROETHANE	107-06-2	37	0	NA
1,2-DICHLOROETHYLENE	540-59-0	4	0	NA
1,2-DICHLOROPROPANE	78-87-5	37	0	NA
2-BUTANONE	78-93-3	37	2	14 UG/KG
2-HEXANONE	591-78-6	31	1	4 UG/KG
4-METHYL-2-PENTANONE	108-10-1	37	0	NA
ACETONE	67-64-1	37	4	87 UG/KG
BENZENE	71-43-2	37	0	NA
BROMODICHLOROMETHANE	75-27-4	37	0	NA
BROMOFORM	75-25-2	37	0	NA
BROMOMETHANE	74-83-9	37	0	NA
CARBON DISULFIDE	75-15-0	37	0	NA
CARBON TETRACHLORIDE	56-23-5	37	0	NA
CHLOROBENZENE	108-90-7	37	0	NA

Table 5-9
Chemicals Reported in Soil at CAOC 10.37^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CHLOROETHANE	75-00-3	37	0	NA
CHLOROFORM	67-66-3	37	0	NA
CHLOROMETHANE	74-87-3	37	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	33	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	37	0	NA
DIBROMOCHLOROMETHANE	124-48-1	37	0	NA
ETHYLBENZENE	100-41-4	37	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	4	0	NA
METHYLENE CHLORIDE	75-09-2	37	8	27 UG/KG
STYRENE	100-42-5	37	0	NA
TETRACHLOROETHENE	127-18-4	37	7	26548 UG/KG
TOLUENE	108-88-3	37	7	27 UG/KG
TOTAL XYLENES	1330-20-7	37	4	3 UG/KG
TRANS-1,2-DICHLOROETHENE	156-60-5	33	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	37	0	NA
TRICHLOROETHYLENE	79-01-6	37	2	3 UG/KG
VINYL ACETATE	108-05-4	26	0	NA
VINYL CHLORIDE	75-01-4	37	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-10
Chemicals Reported in Groundwater at CAOC 10.37^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Metals				
ALUMINUM	7429-90-5	1	0	NA
ANTIMONY	7440-36-0	1	0	NA
ARSENIC	7440-38-2	1	0	NA
BARIUM	7440-39-3	1	1	55.3 UG/KG
BERYLLIUM	7440-41-7	1	0	NA
BORON	7440-42-8	1	1	1170 UG/KG
CADMIUM	7440-43-9	1	0	NA
CHROMIUM	7440-47-3	1	0	NA
COBALT	7440-48-4	1	0	NA
COPPER	7440-50-8	1	0	NA
LEAD	7439-92-1	1	0	NA
MANGANESE	7439-96-5	1	1	6 UG/KG
MERCURY	7439-97-6	1	0	NA
MOLYBDENUM	7439-98-7	1	0	NA
NICKEL	7440-02-0	1	0	NA
SELENIUM	7782-49-2	1	0	NA
SILVER	7440-22-4	1	0	NA
STRONTIUM	7440-24-6	1	1	1600 UG/KG
THALLIUM	7440-28-0	1	0	NA
VANADIUM	7440-62-2	1	1	5.2 UG/KG
ZINC	7440-66-6	1	0	NA
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	9	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	9	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	9	0	NA
1,1-DICHLOROETHANE	75-34-3	9	0	NA
1,1-DICHLOROETHENE	75-35-4	9	0	NA
1,2-DICHLOROETHANE	107-06-2	9	0	NA
1,2-DICHLOROETHYLENE	540-59-0	8	0	NA
1,2-DICHLOROPROPANE	78-87-5	9	0	NA
2-BUTANONE	78-93-3	3	0	NA
2-HEXANONE	591-78-6	9	0	NA
4-METHYL-2-PENTANONE	108-10-1	9	0	NA
ACETONE	67-64-1	9	0	NA
BENZENE	71-43-2	9	0	NA
BROMODICHLOROMETHANE	75-27-4	9	0	NA
BROMOFORM	75-25-2	9	0	NA
BROMOMETHANE	74-83-9	9	0	NA
CARBON DISULFIDE	75-15-0	9	0	NA
CARBON TETRACHLORIDE	56-23-5	9	0	NA
CHLOROBENZENE	108-90-7	9	0	NA
CHLOROETHANE	75-00-3	9	0	NA
CHLOROFORM	67-66-3	9	1	0.8 UG/KG
CHLOROMETHANE	74-87-3	9	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	1	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	9	0	NA
DIBROMOCHLOROMETHANE	124-48-1	9	0	NA
ETHYLBENZENE	100-41-4	9	0	NA

Table 5-10
Chemicals Reported in Groundwater at CAOC 10.37^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
METHYL TERT-BUTYL ETHER	1634-04-4	8	0	NA
METHYLENE CHLORIDE	75-09-2	9	0	NA
STYRENE	100-42-5	9	0	NA
TETRACHLOROETHENE	127-18-4	9	0	NA
TOLUENE	108-88-3	9	0	NA
TOTAL XYLENES	1330-20-7	9	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	1	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	9	0	NA
TRICHLOROETHYLENE	79-01-6	9	0	NA
VINYL ACETATE	108-05-4	1	0	NA
VINYL CHLORIDE	75-01-4	9	0	NA

Notes:

- ^a table does not include tentatively identified compounds
- ^b table only includes the last four quarters sampled for each location

Acronyms/Abbreviations:

BHC – benzene hexachloride
 CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
 CAS – Chemical Abstracts Service
 2,4-D – (2,4-dichlorophenoxy)-acetic acid
 2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
 DBCP – 1,2-dibromo-3-chloropropane
 DDD – dichlorodiphenyldichloroethane
 DDE – dichlorodiphenyldichloroethene
 DDT – dichlorodiphenyltrichloroethane
 UG/KG – micrograms per kilogram
 UG/L – micrograms per liter
 MCPA – 2-methyl-4-chlorophenoxyacetic acid
 MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
 MG/KG – milligrams per kilogram
 NA – not applicable
 PCB – polychlorinated biphenyl
 PG/G – picograms per gram
 PPBV – parts per billion per volume
 PPMV – parts per million per volume
 2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
 2,4,5-TP – silvex acid

Table 5-11
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 1*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	19	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	5	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	5	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	19	0	NA
1,1-DICHLOROETHANE	75-34-3	19	0	NA
1,1-DICHLOROETHENE	75-35-4	19	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	5	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	5	0	NA
1,2-DIBROMOETHANE	106-93-4	19	0	NA
1,2-DICHLOROBENZENE	95-50-1	5	0	NA
1,2-DICHLOROETHANE	107-06-2	5	0	NA
1,2-DICHLOROPROPANE	78-87-5	5	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	5	0	NA
1,3-DICHLOROBENZENE	541-73-1	5	0	NA
1,4-DICHLOROBENZENE	106-46-7	5	0	NA
2-BUTANONE	78-93-3	14	1	1.9 UG/L
2-HEXANONE	591-78-6	5	0	NA
4-METHYL-2-PENTANONE	108-10-1	5	0	NA
BENZENE	71-43-2	19	0	NA
BROMODICHLOROMETHANE	75-27-4	5	0	NA
BROMOFORM	75-25-2	5	0	NA
BROMOMETHANE	74-83-9	5	0	NA
CARBON DISULFIDE	75-15-0	5	0	NA
CARBON TETRACHLORIDE	56-23-5	19	0	NA
CHLOROBENZENE	108-90-7	5	0	NA
CHLOROETHANE	75-00-3	5	0	NA
CHLOROFORM	67-66-3	19	0	NA
CHLOROMETHANE	74-87-3	5	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	19	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	5	0	NA
DBCP	96-12-8	5	0	NA
DIBROMOCHLOROMETHANE	124-48-1	19	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	5	0	NA
ETHYLBENZENE	100-41-4	19	0	NA
HEXACHLOROBUTADIENE	87-68-3	5	0	NA
M,P-XYLENE	7816-60-0	5	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	19	1	1.2 UG/L
METHYLENE CHLORIDE	75-09-2	19	0	NA
NAPHTHALENE	91-20-3	5	0	NA
O-XYLENE	95-47-6	5	0	NA
STYRENE	100-42-5	5	0	NA
TETRACHLOROETHENE	127-18-4	19	0	NA
TOLUENE	108-88-3	19	3	1.9 UG/L
TOTAL XYLENES	1330-20-7	14	2	4.6 UG/L
TRANS-1,2-DICHLOROETHENE	156-60-5	19	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	5	0	NA
TRICHLOROETHYLENE	79-01-6	19	0	NA

Table 5-11
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 1*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
TRICHLOROFLUOROMETHANE	75-69-4	5	0	NA
VINYL CHLORIDE	75-01-4	5	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-12
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Carbamates				
CHLOROPROPHAM	101-21-3	1	1	50 UG/KG
Herbicides				
2,4,5-T	93-76-5	1	0	NA
2,4-D (ACID)	94-75-7	3	2	73.6 UG/KG
2,4-DB	94-82-6	1	0	NA
SILVEX	93-72-1	3	2	6.9 UG/KG
Metals				
ALUMINUM	7429-90-5	8	8	20900 MG/KG
ANTIMONY	7440-36-0	1	0	NA
ARSENIC	7440-38-2	8	7	14.1 MG/KG
BARIUM	7440-39-3	8	8	185 MG/KG
BERYLLIUM	7440-41-7	8	7	1.1 MG/KG
BORON	7440-42-8	8	5	83.1 MG/KG
CADMIUM	7440-43-9	8	7	6.2 MG/KG
CHROMIUM	7440-47-3	1	1	3.4 MG/KG
COBALT	7440-48-4	1	1	1.5 MG/KG
COPPER	7440-50-8	8	8	18 MG/KG
CYANIDES	57-12-5	1	0	NA
LEAD	7439-92-1	8	8	12.1 MG/KG
MANGANESE	7439-96-5	8	8	460 MG/KG
MERCURY	7439-97-6	8	0	NA
MOLYBDENUM	7439-98-7	1	0	NA
NICKEL	7440-02-0	1	1	2.9 MG/KG
SELENIUM	7782-49-2	4	0	NA
SILVER	7440-22-4	1	0	NA
STRONTIUM	7440-24-6	8	8	226 MG/KG
THALLIUM	7440-28-0	8	3	1.2 MG/KG
VANADIUM	7440-62-2	1	1	15.8 MG/KG
ZINC	7440-66-6	8	8	62.2 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	12	0	NA
4,4'-DDE	72-55-9	12	0	NA
4,4'-DDT	50-29-3	12	0	NA
ALDRIN	309-00-2	5	0	NA
ALPHA-BHC	319-84-6	5	0	NA
ALPHA-CHLORDANE	5103-71-9	11	0	NA
BETA-BHC	319-85-7	5	0	NA
CHLORDANE	57-74-9	1	0	NA
DELTA-BHC	319-86-8	5	0	NA
DIELDRIN	60-57-1	12	1	0.28 UG/KG
ENDOSULFAN SULFATE	1031-07-8	5	0	NA
ENDOSULFAN-I	959-98-8	5	0	NA
ENDOSULFAN-II	33213-65-9	5	0	NA
ENDRIN	72-20-8	5	0	NA
ENDRIN ALDEHYDE	7421-93-4	5	0	NA
ENDRIN KETONE	53494-70-5	5	0	NA
GAMMA-BHC (LINDANE)	58-89-9	5	0	NA
GAMMA-CHLORDANE	5566-34-7	11	0	NA

Table 5-12
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
HEPTACHLOR	76-44-8	5	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	5	0	NA
METHOMYL	16752-77-5	7	1	155 UG/KG
METHOXYCHLOR	72-43-5	5	0	NA
AROCLOR 1016	12674-11-2	5	0	NA
AROCLOR 1221	11104-28-2	5	0	NA
AROCLOR 1232	11141-16-5	5	0	NA
AROCLOR 1242	53469-21-9	5	0	NA
AROCLOR 1248	12672-29-6	5	0	NA
AROCLOR 1254	11097-69-1	5	0	NA
AROCLOR 1260	11096-82-5	5	0	NA
TOXAPHENE	8001-35-2	5	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	5	0	NA
1,2-DICHLOROBENZENE	95-50-1	5	0	NA
1,2-DIPHENYLHYDRAZINE	122-66-7	1	0	NA
1,3-DICHLOROBENZENE	541-73-1	5	0	NA
1,4-DICHLOROBENZENE	106-46-7	5	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	4	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	5	0	NA
2,4-DICHLOROPHENOL	120-83-2	5	0	NA
2,4-DIMETHYLPHENOL	105-67-9	5	0	NA
2,4-DINITROPHENOL	51-28-5	5	0	NA
2,4-DINITROTOLUENE	121-14-2	5	0	NA
2,6-DINITROTOLUENE	606-20-2	5	0	NA
2-CHLORONAPHTHALENE	91-58-7	5	0	NA
2-CHLOROPHENOL	95-57-8	5	0	NA
2-METHYLNAPHTHALENE	91-57-6	4	0	NA
2-METHYLPHENOL	95-48-7	4	0	NA
2-NITROANILINE	88-74-4	4	0	NA
2-NITROPHENOL	88-75-5	5	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	5	0	NA
3-NITROANILINE	99-09-2	4	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	5	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	5	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	5	0	NA
4-CHLOROANILINE	106-47-8	4	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	5	0	NA
4-METHYLPHENOL	106-44-5	4	0	NA
4-NITROANILINE	100-01-6	4	0	NA
4-NITROPHENOL	100-02-7	5	0	NA
ACENAPHTHENE	83-32-9	5	0	NA
ACENAPHTHYLENE	208-96-8	5	0	NA
ANTHRACENE	120-12-7	5	0	NA
BENZIDINE	92-87-5	1	0	NA
BENZO(A)ANTHRACENE	56-55-3	5	0	NA
BENZO(A)PYRENE	50-32-8	5	0	NA
BENZO(B)FLUORANTHENE	205-99-2	5	0	NA
BENZO(GHI)PERYLENE	191-24-2	5	0	NA

Table 5-12
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BENZO(K)FLUORANTHENE	207-08-9	5	0	NA
BENZOIC ACID	65-85-0	3	0	NA
BENZYL ALCOHOL	100-51-6	3	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	5	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	5	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	5	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	5	1	0.58 MG/KG
BUTYL BENZYL PHTHALATE	85-68-7	12	0	NA
CARBAZOLE	86-74-8	1	0	NA
CHRYSENE	218-01-9	5	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	12	4	1304 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	5	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	5	0	NA
DIBENZOFURAN	132-64-9	4	0	NA
DIETHYL PHTHALATE	84-66-2	5	0	NA
DIMETHYL PHTHALATE	131-11-3	5	0	NA
FLUORANTHENE	206-44-0	5	0	NA
FLUORENE	86-73-7	5	0	NA
HEXACHLOROBENZENE	118-74-1	5	0	NA
HEXACHLOROBUTADIENE	87-68-3	5	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	5	0	NA
HEXACHLOROETHANE	67-72-1	5	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	5	0	NA
ISOPHORONE	78-59-1	5	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	5	0	NA
N-NITROSODIMETHYLAMINE	62-75-9	1	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	5	0	NA
NAPHTHALENE	91-20-3	5	0	NA
NITROBENZENE	98-95-3	5	0	NA
PENTACHLOROPHENOL	87-86-5	5	0	NA
PHENANTHRENE	85-01-8	12	0	NA
PHENOL	108-95-2	5	0	NA
PYRENE	129-00-0	5	0	NA
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	1	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	1	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	1	0	NA
1,1-DICHLOROETHANE	75-34-3	1	0	NA
1,1-DICHLOROETHENE	75-35-4	1	0	NA
1,2-DICHLOROETHANE	107-06-2	1	0	NA
1,2-DICHLOROPROPANE	78-87-5	1	0	NA
2-BUTANONE	78-93-3	1	0	NA
2-HEXANONE	591-78-6	1	0	NA
4-METHYL-2-PENTANONE	108-10-1	1	0	NA
ACETONE	67-64-1	8	7	113 UG/KG
BENZENE	71-43-2	1	0	NA
BROMODICHLOROMETHANE	75-27-4	1	0	NA
BROMOFORM	75-25-2	1	0	NA
BROMOMETHANE	74-83-9	1	0	NA

Table 5-12
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CARBON DISULFIDE	75-15-0	1	0	NA
CARBON TETRACHLORIDE	56-23-5	1	0	NA
CHLOROBENZENE	108-90-7	1	0	NA
CHLOROETHANE	75-00-3	1	0	NA
CHLOROFORM	67-66-3	1	0	NA
CHLOROMETHANE	74-87-3	1	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	1	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	1	0	NA
DIBROMOCHLOROMETHANE	124-48-1	1	0	NA
ETHYLBENZENE	100-41-4	1	0	NA
METHYLENE CHLORIDE	75-09-2	8	4	26 UG/KG
STYRENE	100-42-5	1	0	NA
TETRACHLOROETHENE	127-18-4	1	0	NA
TOLUENE	108-88-3	1	0	NA
TOTAL XYLENES	1330-20-7	1	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	1	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	1	0	NA
TRICHLOROETHYLENE	79-01-6	1	0	NA
VINYL CHLORIDE	75-01-4	1	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-13
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 1*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Metals				
BARIUM	7440-39-3	2	2	33.3 UG/KG
Pesticides/PCB				
DIELDRIN	60-57-1	1	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	1	0	NA
1,2-DICHLOROBENZENE	95-50-1	1	0	NA
1,3-DICHLOROBENZENE	541-73-1	1	0	NA
1,4-DICHLOROBENZENE	106-46-7	1	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	1	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	1	0	NA
2,4-DICHLOROPHENOL	120-83-2	1	0	NA
2,4-DIMETHYLPHENOL	105-67-9	1	0	NA
2,4-DINITROPHENOL	51-28-5	1	0	NA
2,4-DINITROTOLUENE	121-14-2	1	0	NA
2,6-DINITROTOLUENE	606-20-2	1	0	NA
2-CHLORONAPHTHALENE	91-58-7	1	0	NA
2-CHLOROPHENOL	95-57-8	1	0	NA
2-METHYLNAPHTHALENE	91-57-6	1	0	NA
2-METHYLPHENOL	95-48-7	1	0	NA
2-NITROANILINE	88-74-4	1	0	NA
2-NITROPHENOL	88-75-5	1	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	1	0	NA
3-NITROANILINE	99-09-2	1	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	1	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	1	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	1	0	NA
4-CHLOROANILINE	106-47-8	1	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	1	0	NA
4-METHYLPHENOL	106-44-5	1	0	NA
4-NITROANILINE	100-01-6	1	0	NA
4-NITROPHENOL	100-02-7	1	0	NA
ACENAPHTHENE	83-32-9	1	0	NA
ACENAPHTHYLENE	208-96-8	1	0	NA
ANTHRACENE	120-12-7	1	0	NA
BENZO(A)ANTHRACENE	56-55-3	1	0	NA
BENZO(A)PYRENE	50-32-8	1	0	NA
BENZO(B)FLUORANTHENE	205-99-2	1	0	NA
BENZO(GHI)PERYLENE	191-24-2	1	0	NA
BENZO(K)FLUORANTHENE	207-08-9	1	0	NA
BENZOIC ACID	65-85-0	1	0	NA
BENZYL ALCOHOL	100-51-6	1	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	1	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	1	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	1	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	1	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	1	0	NA
CHRYSENE	218-01-9	1	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	1	0	NA

Table 5-13
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 1*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
DI-N-OCTYL PHTHALATE	117-84-0	1	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	1	0	NA
DIBENZOFURAN	132-64-9	1	0	NA
DIETHYL PHTHALATE	84-66-2	1	0	NA
DIMETHYL PHTHALATE	131-11-3	1	0	NA
FLUORANTHENE	206-44-0	1	0	NA
FLUORENE	86-73-7	1	0	NA
HEXACHLOROBENZENE	118-74-1	1	0	NA
HEXACHLOROBUTADIENE	87-68-3	1	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	1	0	NA
HEXACHLOROETHANE	67-72-1	1	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	1	0	NA
ISOPHORONE	78-59-1	1	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	1	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	1	0	NA
NAPHTHALENE	91-20-3	1	0	NA
NITROBENZENE	98-95-3	1	0	NA
PENTACHLOROPHENOL	87-86-5	1	0	NA
PHENANTHRENE	85-01-8	1	0	NA
PHENOL	108-95-2	1	0	NA
PYRENE	129-00-0	1	0	NA
Volatile Organic Compounds				
1,1,1,2-TETRACHLOROETHANE	630-20-6	2	0	NA
1,1,1-TRICHLOROETHANE	71-55-6	6	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	6	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	4	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	6	0	NA
1,1-DICHLOROETHANE	75-34-3	6	0	NA
1,1-DICHLOROETHENE	75-35-4	6	0	NA
1,1-DICHLOROPROPENE	563-58-6	2	0	NA
1,2,3-TRICHLOROBENZENE	87-61-6	2	0	NA
1,2,3-TRICHLOROPROPANE	96-18-4	2	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	2	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	2	0	NA
1,2-DIBROMOETHANE	106-93-4	2	0	NA
1,2-DICHLOROBENZENE	95-50-1	2	0	NA
1,2-DICHLOROETHANE	107-06-2	6	0	NA
1,2-DICHLOROPROPANE	78-87-5	6	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	4	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	2	0	NA
1,3-DICHLOROBENZENE	541-73-1	2	0	NA
1,3-DICHLOROPROPANE	142-28-9	2	0	NA
1,4-DICHLOROBENZENE	106-46-7	2	0	NA
1-CHLOROHEXANE	544-10-5	2	0	NA
2-BUTANONE	78-93-3	4	0	NA
2-HEXANONE	591-78-6	4	0	NA
4-METHYL-2-PENTANONE	108-10-1	4	0	NA
ACETONE	67-64-1	4	0	NA
BENZENE	71-43-2	6	0	NA

Table 5-13
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 1*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BROMOBENZENE	108-86-1	2	0	NA
BROMOCHLOROMETHANE	74-97-5	2	0	NA
BROMODICHLOROMETHANE	75-27-4	6	0	NA
BROMOFORM	75-25-2	6	0	NA
BROMOMETHANE	74-83-9	6	0	NA
BUTANE, 2-METHOXY-2-METHYL-	994-05-8	1	0	NA
CARBON DISULFIDE	75-15-0	4	1	0.4 UG/KG
CARBON TETRACHLORIDE	56-23-5	6	0	NA
CHLOROBENZENE	108-90-7	6	0	NA
CHLOROETHANE	75-00-3	6	0	NA
CHLOROFORM	67-66-3	6	0	NA
CHLOROMETHANE	74-87-3	6	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	6	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	6	0	NA
CUMENE	98-82-8	2	0	NA
DBCP	96-12-8	2	0	NA
DIBROMOCHLOROMETHANE	124-48-1	6	0	NA
DIBROMOMETHANE	74-95-3	2	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	6	0	NA
DIISOPROPYL ETHER	108-20-3	1	0	NA
ETHYLBENZENE	100-41-4	6	0	NA
HEXACHLOROBUTADIENE	87-68-3	2	0	NA
ISOPROPANOL	67-63-0	4	0	NA
M,P-XYLENE	7816-60-0	2	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	4	0	NA
METHYLENE CHLORIDE	75-09-2	6	1	2.1 UG/KG
N-BUTYLBENZENE	104-51-8	2	0	NA
N-PROPYLBENZENE	103-65-1	2	0	NA
NAPHTHALENE	91-20-3	2	0	NA
O-CHLOROTOLUENE	95-49-8	2	0	NA
O-XYLENE	95-47-6	2	0	NA
P-CHLOROTOLUENE	106-43-4	2	0	NA
P-CYMENE	99-87-6	2	0	NA
PROPANE, 2-ETHOXY-2-METHYL-	637-92-3	1	0	NA
SEC-BUTYLBENZENE	135-98-8	2	0	NA
SEC-DICHLOROPROPANE	594-20-7	2	0	NA
STYRENE	100-42-5	6	0	NA
TERT-BUTYLBENZENE	98-06-6	2	0	NA
TETRACHLOROETHENE	127-18-4	6	5	1 UG/KG
TOLUENE	108-88-3	6	3	1 UG/KG
TOTAL XYLENES	1330-20-7	4	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	6	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	6	0	NA
TRICHLOROETHYLENE	79-01-6	6	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	6	0	NA
VINYL CHLORIDE	75-01-4	6	0	NA

Table 5-13
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 1*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-14
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 2*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	10	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	10	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	10	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	10	0	NA
1,1-DICHLOROETHANE	75-34-3	10	0	NA
1,1-DICHLOROETHENE	75-35-4	10	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	10	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	10	0	NA
1,2-DIBROMOETHANE	106-93-4	10	0	NA
1,2-DICHLOROBENZENE	95-50-1	10	0	NA
1,2-DICHLOROETHANE	107-06-2	10	0	NA
1,2-DICHLOROPROPANE	78-87-5	10	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	10	0	NA
1,3-DICHLOROBENZENE	541-73-1	10	0	NA
1,4-DICHLOROBENZENE	106-46-7	10	0	NA
2-HEXANONE	591-78-6	10	0	NA
4-METHYL-2-PENTANONE	108-10-1	10	0	NA
BENZENE	71-43-2	10	0	NA
BROMODICHLOROMETHANE	75-27-4	10	0	NA
BROMOFORM	75-25-2	10	0	NA
BROMOMETHANE	74-83-9	10	0	NA
CARBON DISULFIDE	75-15-0	10	0	NA
CARBON TETRACHLORIDE	56-23-5	10	0	NA
CHLOROBENZENE	108-90-7	10	0	NA
CHLOROETHANE	75-00-3	10	0	NA
CHLOROFORM	67-66-3	10	0	NA
CHLOROMETHANE	74-87-3	10	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	10	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	10	0	NA
DBCP	96-12-8	10	0	NA
DIBROMOCHLOROMETHANE	124-48-1	10	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	10	0	NA
ETHYLBENZENE	100-41-4	10	0	NA
HEXACHLOROBUTADIENE	87-68-3	10	0	NA
M,P-XYLENE	7816-60-0	10	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	10	0	NA
METHYLENE CHLORIDE	75-09-2	10	0	NA
NAPHTHALENE	91-20-3	10	0	NA
O-XYLENE	95-47-6	10	0	NA
STYRENE	100-42-5	10	0	NA
TETRACHLOROETHENE	127-18-4	10	0	NA
TOLUENE	108-88-3	10	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	10	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	10	0	NA
TRICHLOROETHYLENE	79-01-6	10	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	10	0	NA
VINYL CHLORIDE	75-01-4	10	0	NA

Table 5-14
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 2*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-15
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 2^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Ethylene Glycol				
ETHYLENE GLYCOL	107-21-1	4	0	NA
Fuels				
DIESEL	11-84-7	8	0	NA
Metals				
ALUMINUM	7429-90-5	8	8	25200 MG/KG
ANTIMONY	7440-36-0	8	2	12.3 MG/KG
ARSENIC	7440-38-2	8	4	10 MG/KG
BARIUM	7440-39-3	8	8	195 MG/KG
BERYLLIUM	7440-41-7	8	0	NA
BORON	7440-42-8	8	8	52.4 MG/KG
CADMIUM	7440-43-9	8	1	1.2 MG/KG
CHROMIUM	7440-47-3	8	8	26.7 MG/KG
COBALT	7440-48-4	8	8	10.7 MG/KG
COPPER	7440-50-8	8	8	24.1 MG/KG
CYANIDES	57-12-5	8	0	NA
LEAD	7439-92-1	8	8	16.2 MG/KG
MANGANESE	7439-96-5	8	8	630 MG/KG
MERCURY	7439-97-6	8	0	NA
MOLYBDENUM	7439-98-7	8	0	NA
NICKEL	7440-02-0	8	8	22.8 MG/KG
SELENIUM	7782-49-2	8	4	2 MG/KG
SILVER	7440-22-4	8	6	6.3 MG/KG
STRONTIUM	7440-24-6	8	8	344 MG/KG
THALLIUM	7440-28-0	8	2	1.5 MG/KG
VANADIUM	7440-62-2	8	8	52.6 MG/KG
ZINC	7440-66-6	8	8	95.1 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	5	0	NA
4,4'-DDE	72-55-9	5	0	NA
4,4'-DDT	50-29-3	5	0	NA
ALDRIN	309-00-2	5	0	NA
ALPHA-BHC	319-84-6	5	0	NA
ALPHA-CHLORDANE	5103-71-9	5	0	NA
BETA-BHC	319-85-7	5	0	NA
DELTA-BHC	319-86-8	5	0	NA
DIELDRIN	60-57-1	5	0	NA
ENDOSULFAN SULFATE	1031-07-8	5	0	NA
ENDOSULFAN-I	959-98-8	5	0	NA
ENDOSULFAN-II	33213-65-9	5	0	NA
ENDRIN	72-20-8	5	1	1.9 UG/KG
ENDRIN ALDEHYDE	7421-93-4	5	0	NA
ENDRIN KETONE	53494-70-5	5	1	2.28 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	5	0	NA
GAMMA-CHLORDANE	5566-34-7	5	0	NA
HEPTACHLOR	76-44-8	5	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	5	0	NA
METHOXYCHLOR	72-43-5	5	1	8.1 UG/KG
AROCLOR 1016	12674-11-2	12	0	NA

Table 5-15
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 2^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1221	11104-28-2	12	0	NA
AROCLOR 1232	11141-16-5	12	0	NA
AROCLOR 1242	53469-21-9	12	0	NA
AROCLOR 1248	12672-29-6	12	0	NA
AROCLOR 1254	11097-69-1	12	0	NA
AROCLOR 1260	11096-82-5	12	0	NA
TOXAPHENE	8001-35-2	5	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	18	0	NA
1,2-DICHLOROBENZENE	95-50-1	18	0	NA
1,3-DICHLOROBENZENE	541-73-1	18	0	NA
1,4-DICHLOROBENZENE	106-46-7	18	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	18	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	18	0	NA
2,4-DICHLOROPHENOL	120-83-2	18	0	NA
2,4-DIMETHYLPHENOL	105-67-9	18	0	NA
2,4-DINITROPHENOL	51-28-5	17	0	NA
2,4-DINITROTOLUENE	121-14-2	18	0	NA
2,6-DINITROTOLUENE	606-20-2	18	0	NA
2-CHLORONAPHTHALENE	91-58-7	18	0	NA
2-CHLOROPHENOL	95-57-8	18	0	NA
2-METHYLNAPHTHALENE	91-57-6	18	2	39 UG/KG
2-METHYLPHENOL	95-48-7	18	0	NA
2-NITROANILINE	88-74-4	18	0	NA
2-NITROPHENOL	88-75-5	18	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	18	0	NA
3-NITROANILINE	99-09-2	18	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	4	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	18	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	18	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	18	0	NA
4-CHLOROANILINE	106-47-8	18	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	18	0	NA
4-METHYLPHENOL	106-44-5	18	0	NA
4-NITROANILINE	100-01-6	18	0	NA
4-NITROPHENOL	100-02-7	18	0	NA
ACENAPHTHENE	83-32-9	18	0	NA
ACENAPHTHYLENE	208-96-8	18	0	NA
ANILINE	62-53-3	8	0	NA
ANTHRACENE	120-12-7	18	0	NA
BENZO(A)ANTHRACENE	56-55-3	18	0	NA
BENZO(A)PYRENE	50-32-8	18	0	NA
BENZO(B)FLUORANTHENE	205-99-2	18	0	NA
BENZO(GHI)PERYLENE	191-24-2	18	0	NA
BENZO(K)FLUORANTHENE	207-08-9	18	0	NA
BENZOIC ACID	65-85-0	10	0	NA
BENZYL ALCOHOL	100-51-6	10	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	18	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	18	0	NA

Table 5-15
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 2^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BIS(2-CHLOROETHYL) ETHER	111-44-4	18	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	18	3	690 UG/KG
BISPHENOL A	80-05-7	8	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	18	3	437 UG/KG
CARBAZOLE	86-74-8	8	0	NA
CHRYSENE	218-01-9	18	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	18	6	2666 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	18	1	0.02 MG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	18	0	NA
DIBENZOFURAN	132-64-9	18	0	NA
DIETHYL PHTHALATE	84-66-2	18	0	NA
DIMETHYL PHTHALATE	131-11-3	18	0	NA
FLUORANTHENE	206-44-0	18	1	10 UG/KG
FLUORENE	86-73-7	18	0	NA
HEXACHLOROBENZENE	118-74-1	18	0	NA
HEXACHLOROBUTADIENE	87-68-3	18	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	18	0	NA
HEXACHLOROETHANE	67-72-1	18	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	18	0	NA
ISOPHORONE	78-59-1	18	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	18	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	18	0	NA
NAPHTHALENE	91-20-3	18	2	38 UG/KG
NITROBENZENE	98-95-3	18	0	NA
PENTACHLOROPHENOL	87-86-5	18	0	NA
PHENANTHRENE	85-01-8	18	0	NA
PHENOL	108-95-2	18	0	NA
PYRENE	129-00-0	18	2	11 UG/KG
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	2	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	2	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	2	0	NA
1,1-DICHLOROETHANE	75-34-3	2	0	NA
1,1-DICHLOROETHENE	75-35-4	2	0	NA
1,2-DICHLOROETHANE	107-06-2	2	0	NA
1,2-DICHLOROPROPANE	78-87-5	2	0	NA
2-BUTANONE	78-93-3	2	1	7 UG/KG
2-HEXANONE	591-78-6	2	0	NA
4-METHYL-2-PENTANONE	108-10-1	2	0	NA
ACETONE	67-64-1	2	0	NA
BENZENE	71-43-2	2	0	NA
BROMODICHLOROMETHANE	75-27-4	2	0	NA
BROMOFORM	75-25-2	2	0	NA
BROMOMETHANE	74-83-9	2	0	NA
CARBON DISULFIDE	75-15-0	2	0	NA
CARBON TETRACHLORIDE	56-23-5	2	0	NA
CHLOROBENZENE	108-90-7	2	0	NA
CHLOROETHANE	75-00-3	2	0	NA
CHLOROFORM	67-66-3	2	0	NA

Table 5-15
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 2^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CHLOROMETHANE	74-87-3	2	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	2	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	2	0	NA
DIBROMOCHLOROMETHANE	124-48-1	2	0	NA
ETHYLBENZENE	100-41-4	2	1	4 UG/KG
METHYLENE CHLORIDE	75-09-2	2	0	NA
STYRENE	100-42-5	2	0	NA
TETRACHLOROETHENE	127-18-4	2	0	NA
TOLUENE	108-88-3	2	0	NA
TOTAL XYLENES	1330-20-7	2	1	12 UG/KG
TRANS-1,2-DICHLOROETHENE	156-60-5	2	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	2	0	NA
TRICHLOROETHYLENE	79-01-6	2	0	NA
VINYL ACETATE	108-05-4	2	0	NA
VINYL CHLORIDE	75-01-4	2	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-16
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 3*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	3	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	3	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	3	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	3	0	NA
1,1-DICHLOROETHANE	75-34-3	3	0	NA
1,1-DICHLOROETHENE	75-35-4	3	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	3	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	3	0	NA
1,2-DIBROMOETHANE	106-93-4	3	0	NA
1,2-DICHLOROBENZENE	95-50-1	3	0	NA
1,2-DICHLOROETHANE	107-06-2	3	0	NA
1,2-DICHLOROPROPANE	78-87-5	3	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	3	0	NA
1,3-DICHLOROBENZENE	541-73-1	3	0	NA
1,4-DICHLOROBENZENE	106-46-7	3	0	NA
2-HEXANONE	591-78-6	3	0	NA
4-METHYL-2-PENTANONE	108-10-1	3	0	NA
BENZENE	71-43-2	3	0	NA
BROMODICHLOROMETHANE	75-27-4	3	0	NA
BROMOFORM	75-25-2	3	0	NA
BROMOMETHANE	74-83-9	3	0	NA
CARBON DISULFIDE	75-15-0	3	0	NA
CARBON TETRACHLORIDE	56-23-5	3	0	NA
CHLOROBENZENE	108-90-7	3	0	NA
CHLOROETHANE	75-00-3	3	0	NA
CHLOROFORM	67-66-3	3	0	NA
CHLOROMETHANE	74-87-3	3	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	3	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	3	0	NA
DBCP	96-12-8	3	0	NA
DIBROMOCHLOROMETHANE	124-48-1	3	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	3	0	NA
ETHYLBENZENE	100-41-4	3	0	NA
HEXACHLOROBUTADIENE	87-68-3	3	0	NA
M,P-XYLENE	7816-60-0	3	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	3	0	NA
METHYLENE CHLORIDE	75-09-2	3	0	NA
NAPHTHALENE	91-20-3	3	0	NA
O-XYLENE	95-47-6	3	0	NA
STYRENE	100-42-5	3	0	NA
TETRACHLOROETHENE	127-18-4	3	0	NA
TOLUENE	108-88-3	3	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	3	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	3	0	NA
TRICHLOROETHYLENE	79-01-6	3	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	3	0	NA
VINYL CHLORIDE	75-01-4	3	0	NA

Table 5-16
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 3*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-17
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 3^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Fuels				
DIESEL	11-84-7	10	1	2200 MG/KG
Metals				
ALUMINUM	7429-90-5	12	12	8450 MG/KG
ANTIMONY	7440-36-0	12	0	NA
ARSENIC	7440-38-2	12	11	6.2 MG/KG
BARIUM	7440-39-3	12	12	107 MG/KG
BERYLLIUM	7440-41-7	12	0	NA
BORON	7440-42-8	12	11	35.2 MG/KG
CADMIUM	7440-43-9	12	1	3.8 MG/KG
CHROMIUM	7440-47-3	12	12	32.2 MG/KG
COBALT	7440-48-4	12	10	10.6 MG/KG
COPPER	7440-50-8	12	12	66.2 MG/KG
CYANIDES	57-12-5	14	0	NA
LEAD	7439-92-1	12	12	81.3 MG/KG
MANGANESE	7439-96-5	12	12	343 MG/KG
MERCURY	7439-97-6	12	2	2.4 MG/KG
MOLYBDENUM	7439-98-7	12	2	6.1 MG/KG
NICKEL	7440-02-0	12	10	19.5 MG/KG
SELENIUM	7782-49-2	12	2	1.7 MG/KG
SILVER	7440-22-4	12	5	3.6 MG/KG
STRONTIUM	7440-24-6	12	12	170 MG/KG
THALLIUM	7440-28-0	12	5	3.2 MG/KG
VANADIUM	7440-62-2	12	12	35.4 MG/KG
ZINC	7440-66-6	12	12	579 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	4	2	3.08 UG/KG
4,4'-DDE	72-55-9	4	2	5.65 UG/KG
4,4'-DDT	50-29-3	4	0	NA
ALDRIN	309-00-2	4	1	0.12 UG/KG
ALPHA-BHC	319-84-6	4	0	NA
ALPHA-CHLORDANE	5103-71-9	4	2	1.92 UG/KG
BETA-BHC	319-85-7	4	0	NA
DELTA-BHC	319-86-8	4	0	NA
DIELDRIN	60-57-1	4	1	2.05 UG/KG
ENDOSULFAN SULFATE	1031-07-8	4	2	2.52 UG/KG
ENDOSULFAN-I	959-98-8	4	0	NA
ENDOSULFAN-II	33213-65-9	4	0	NA
ENDRIN	72-20-8	4	0	NA
ENDRIN ALDEHYDE	7421-93-4	4	2	0.75 UG/KG
ENDRIN KETONE	53494-70-5	4	2	1.7 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	4	0	NA
GAMMA-CHLORDANE	5566-34-7	4	1	0.98 UG/KG
HEPTACHLOR	76-44-8	4	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	4	0	NA
METHOXYCHLOR	72-43-5	4	1	3.94 UG/KG
AROCLOR 1016	12674-11-2	5	0	NA
AROCLOR 1221	11104-28-2	5	0	NA
AROCLOR 1232	11141-16-5	5	0	NA

Table 5-17
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 3^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1242	53469-21-9	5	0	NA
AROCLOR 1248	12672-29-6	5	0	NA
AROCLOR 1254	11097-69-1	5	1	40.48 UG/KG
AROCLOR 1260	11096-82-5	5	0	NA
TOXAPHENE	8001-35-2	4	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	12	0	NA
1,2-DICHLOROBENZENE	95-50-1	12	0	NA
1,3-DICHLOROBENZENE	541-73-1	12	0	NA
1,4-DICHLOROBENZENE	106-46-7	12	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	12	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	12	0	NA
2,4-DICHLOROPHENOL	120-83-2	12	0	NA
2,4-DIMETHYLPHENOL	105-67-9	12	0	NA
2,4-DINITROPHENOL	51-28-5	12	0	NA
2,4-DINITROTOLUENE	121-14-2	12	0	NA
2,6-DINITROTOLUENE	606-20-2	12	0	NA
2-CHLORONAPHTHALENE	91-58-7	12	0	NA
2-CHLOROPHENOL	95-57-8	12	0	NA
2-METHYLNAPHTHALENE	91-57-6	12	0	NA
2-METHYLPHENOL	95-48-7	12	0	NA
2-NITROANILINE	88-74-4	12	0	NA
2-NITROPHENOL	88-75-5	12	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	12	0	NA
3-NITROANILINE	99-09-2	12	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	6	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	12	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	12	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	12	0	NA
4-CHLOROANILINE	106-47-8	12	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	12	0	NA
4-METHYLPHENOL	106-44-5	12	0	NA
4-NITROANILINE	100-01-6	12	0	NA
4-NITROPHENOL	100-02-7	12	0	NA
ACENAPHTHENE	83-32-9	12	1	14 UG/KG
ACENAPHTHYLENE	208-96-8	12	0	NA
ANILINE	62-53-3	8	0	NA
ANTHRACENE	120-12-7	12	0	NA
BENZO(A)ANTHRACENE	56-55-3	12	0	NA
BENZO(A)PYRENE	50-32-8	12	0	NA
BENZO(B)FLUORANTHENE	205-99-2	12	0	NA
BENZO(GHI)PERYLENE	191-24-2	12	0	NA
BENZO(K)FLUORANTHENE	207-08-9	12	0	NA
BENZOIC ACID	65-85-0	4	0	NA
BENZYL ALCOHOL	100-51-6	4	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	12	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	12	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	12	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	12	4	419 UG/KG

Table 5-17
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 3^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BISPHENOL A	80-05-7	8	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	12	0	NA
CARBAZOLE	86-74-8	8	0	NA
CHRYSENE	218-01-9	12	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	12	1	106 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	12	1	14 UG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	12	0	NA
DIBENZOFURAN	132-64-9	12	0	NA
DIETHYL PHTHALATE	84-66-2	12	0	NA
DIMETHYL PHTHALATE	131-11-3	12	0	NA
FLUORANTHENE	206-44-0	12	2	157 UG/KG
FLUORENE	86-73-7	12	0	NA
HEXACHLOROBENZENE	118-74-1	12	0	NA
HEXACHLOROBUTADIENE	87-68-3	12	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	12	0	NA
HEXACHLOROETHANE	67-72-1	12	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	12	0	NA
ISOPHORONE	78-59-1	12	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	12	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	12	0	NA
NAPHTHALENE	91-20-3	12	0	NA
NITROBENZENE	98-95-3	12	0	NA
PENTACHLOROPHENOL	87-86-5	12	0	NA
PHENANTHRENE	85-01-8	12	1	201 UG/KG
PHENOL	108-95-2	12	0	NA
PYRENE	129-00-0	12	4	208 UG/KG
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	3	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	3	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	3	0	NA
1,1-DICHLOROETHANE	75-34-3	3	0	NA
1,1-DICHLOROETHENE	75-35-4	3	0	NA
1,2-DICHLOROETHANE	107-06-2	3	0	NA
1,2-DICHLOROPROPANE	78-87-5	3	0	NA
2-BUTANONE	78-93-3	3	0	NA
2-HEXANONE	591-78-6	3	0	NA
4-METHYL-2-PENTANONE	108-10-1	3	0	NA
ACETONE	67-64-1	3	0	NA
BENZENE	71-43-2	3	0	NA
BROMODICHLOROMETHANE	75-27-4	3	0	NA
BROMOFORM	75-25-2	3	0	NA
BROMOMETHANE	74-83-9	3	0	NA
CARBON DISULFIDE	75-15-0	3	0	NA
CARBON TETRACHLORIDE	56-23-5	3	0	NA
CHLOROBENZENE	108-90-7	3	0	NA
CHLOROETHANE	75-00-3	3	0	NA
CHLOROFORM	67-66-3	3	0	NA
CHLOROMETHANE	74-87-3	3	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	3	0	NA

Table 5-17
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 3^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CIS-1,3-DICHLOROPROPENE	10061-01-5	3	0	NA
DIBROMOCHLOROMETHANE	124-48-1	3	0	NA
ETHYLBENZENE	100-41-4	3	0	NA
METHYLENE CHLORIDE	75-09-2	3	0	NA
STYRENE	100-42-5	3	0	NA
TETRACHLOROETHENE	127-18-4	3	0	NA
TOLUENE	108-88-3	3	0	NA
TOTAL XYLENES	1330-20-7	3	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	3	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	3	0	NA
TRICHLOROETHYLENE	79-01-6	3	0	NA
VINYL ACETATE	108-05-4	3	0	NA
VINYL CHLORIDE	75-01-4	3	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPA – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-18
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 3*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Metals				
BARIUM	7440-39-3	5	5	33.6 UG/KG
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	11	0	NA
1,1,2,2-TETRACHLORODIFLUOROETHANE	76-12-0	9	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	11	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	11	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	11	0	NA
1,1-DICHLOROETHANE	75-34-3	11	0	NA
1,1-DICHLOROETHENE	75-35-4	11	0	NA
1,2-DICHLOROETHANE	107-06-2	11	0	NA
1,2-DICHLOROETHYLENE	540-59-0	1	0	NA
1,2-DICHLOROPROPANE	78-87-5	11	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	2	0	NA
2-BUTANONE	78-93-3	11	0	NA
2-HEXANONE	591-78-6	11	0	NA
4-METHYL-2-PENTANONE	108-10-1	11	1	0.3 UG/KG
ACETONE	67-64-1	11	1	8 UG/KG
BENZENE	71-43-2	11	0	NA
BROMODICHLOROMETHANE	75-27-4	11	0	NA
BROMOFORM	75-25-2	11	0	NA
BROMOMETHANE	74-83-9	11	0	NA
BUTANE, 2-METHOXY-2-METHYL-	994-05-8	2	0	NA
CARBON DISULFIDE	75-15-0	11	1	0.3 UG/KG
CARBON TETRACHLORIDE	56-23-5	11	0	NA
CHLOROBENZENE	108-90-7	11	0	NA
CHLOROETHANE	75-00-3	11	0	NA
CHLOROFORM	67-66-3	11	0	NA
CHLOROMETHANE	74-87-3	11	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	11	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	11	0	NA
DIBROMOCHLOROMETHANE	124-48-1	11	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	11	0	NA
DIISOPROPYL ETHER	108-20-3	2	0	NA
ETHYLBENZENE	100-41-4	11	0	NA
ISOPROPANOL	67-63-0	7	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	8	0	NA
METHYLENE CHLORIDE	75-09-2	11	0	NA
PROPANE, 2-ETHOXY-2-METHYL-	637-92-3	2	0	NA
STYRENE	100-42-5	11	0	NA
TETRACHLOROETHENE	127-18-4	11	7	1 UG/KG
TOLUENE	108-88-3	11	2	0.7 UG/KG
TOTAL XYLENES	1330-20-7	11	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	11	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	11	0	NA
TRICHLOROETHYLENE	79-01-6	11	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	11	0	NA
VINYL CHLORIDE	75-01-4	11	0	NA

Table 5-18
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 3*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-19
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 4*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	7	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	7	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	7	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	7	0	NA
1,1-DICHLOROETHANE	75-34-3	7	0	NA
1,1-DICHLOROETHENE	75-35-4	7	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	7	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	7	0	NA
1,2-DIBROMOETHANE	106-93-4	7	0	NA
1,2-DICHLOROBENZENE	95-50-1	7	0	NA
1,2-DICHLOROETHANE	107-06-2	7	0	NA
1,2-DICHLOROPROPANE	78-87-5	7	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	7	0	NA
1,3-DICHLOROBENZENE	541-73-1	7	0	NA
1,4-DICHLOROBENZENE	106-46-7	7	0	NA
2-HEXANONE	591-78-6	7	0	NA
4-METHYL-2-PENTANONE	108-10-1	7	0	NA
BENZENE	71-43-2	7	0	NA
BROMODICHLOROMETHANE	75-27-4	7	0	NA
BROMOFORM	75-25-2	7	0	NA
BROMOMETHANE	74-83-9	7	0	NA
CARBON DISULFIDE	75-15-0	7	0	NA
CARBON TETRACHLORIDE	56-23-5	7	0	NA
CHLOROBENZENE	108-90-7	7	0	NA
CHLOROETHANE	75-00-3	7	0	NA
CHLOROFORM	67-66-3	7	0	NA
CHLOROMETHANE	74-87-3	7	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	7	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	7	0	NA
DBCP	96-12-8	7	0	NA
DIBROMOCHLOROMETHANE	124-48-1	7	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	7	0	NA
ETHYLBENZENE	100-41-4	7	0	NA
HEXACHLOROBUTADIENE	87-68-3	7	0	NA
M,P-XYLENE	7816-60-0	7	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	7	0	NA
METHYLENE CHLORIDE	75-09-2	7	0	NA
NAPHTHALENE	91-20-3	7	0	NA
O-XYLENE	95-47-6	7	0	NA
STYRENE	100-42-5	7	0	NA
TETRACHLOROETHENE	127-18-4	7	0	NA
TOLUENE	108-88-3	7	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	7	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	7	0	NA
TRICHLOROETHYLENE	79-01-6	7	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	7	0	NA
VINYL CHLORIDE	75-01-4	7	0	NA

Table 5-19
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 4*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-20
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 4^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Ethylene Glycol				
ETHYLENE GLYCOL	107-21-1	3	0	NA
Fuels				
DIESEL	11-84-7	10	0	NA
Metals				
ALUMINUM	7429-90-5	12	12	15700 MG/KG
ANTIMONY	7440-36-0	12	0	NA
ARSENIC	7440-38-2	12	4	5.9 MG/KG
BARIUM	7440-39-3	12	12	394 MG/KG
BERYLLIUM	7440-41-7	12	0	NA
BORON	7440-42-8	12	11	38.2 MG/KG
CADMIUM	7440-43-9	12	0	NA
CHROMIUM	7440-47-3	12	12	9.8 MG/KG
COBALT	7440-48-4	12	10	8.2 MG/KG
COPPER	7440-50-8	12	12	27.1 MG/KG
CYANIDES	57-12-5	13	1	1.2 MG/KG
LEAD	7439-92-1	12	10	40.6 MG/KG
MANGANESE	7439-96-5	12	12	273 MG/KG
MERCURY	7439-97-6	12	0	NA
MOLYBDENUM	7439-98-7	12	0	NA
NICKEL	7440-02-0	12	10	10.7 MG/KG
SELENIUM	7782-49-2	12	4	1.6 MG/KG
SILVER	7440-22-4	12	6	3.7 MG/KG
STRONTIUM	7440-24-6	12	12	117 MG/KG
THALLIUM	7440-28-0	12	0	NA
VANADIUM	7440-62-2	12	12	40.5 MG/KG
ZINC	7440-66-6	12	12	50.9 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	10	2	0.42 UG/KG
4,4'-DDE	72-55-9	10	3	1.16 UG/KG
4,4'-DDT	50-29-3	10	1	0.52 UG/KG
ALDRIN	309-00-2	10	0	NA
ALPHA-BHC	319-84-6	10	0	NA
ALPHA-CHLORDANE	5103-71-9	10	1	1.33 UG/KG
BETA-BHC	319-85-7	10	0	NA
DELTA-BHC	319-86-8	10	0	NA
DIELDRIN	60-57-1	10	0	NA
ENDOSULFAN SULFATE	1031-07-8	10	1	0.39 UG/KG
ENDOSULFAN-I	959-98-8	10	0	NA
ENDOSULFAN-II	33213-65-9	10	0	NA
ENDRIN	72-20-8	10	1	0.5 UG/KG
ENDRIN ALDEHYDE	7421-93-4	10	0	NA
ENDRIN KETONE	53494-70-5	10	2	0.45 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	10	0	NA
GAMMA-CHLORDANE	5566-34-7	10	2	1.58 UG/KG
HEPTACHLOR	76-44-8	10	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	10	0	NA
METHOXYCHLOR	72-43-5	10	0	NA
AROCLOR 1016	12674-11-2	18	0	NA

Table 5-20
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 4^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1221	11104-28-2	18	0	NA
AROCLOR 1232	11141-16-5	18	0	NA
AROCLOR 1242	53469-21-9	18	0	NA
AROCLOR 1248	12672-29-6	18	0	NA
AROCLOR 1254	11097-69-1	18	0	NA
AROCLOR 1260	11096-82-5	18	0	NA
TOXAPHENE	8001-35-2	10	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	20	0	NA
1,2-DICHLOROBENZENE	95-50-1	20	0	NA
1,3-DICHLOROBENZENE	541-73-1	20	0	NA
1,4-DICHLOROBENZENE	106-46-7	20	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	20	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	20	0	NA
2,4-DICHLOROPHENOL	120-83-2	20	0	NA
2,4-DIMETHYLPHENOL	105-67-9	20	0	NA
2,4-DINITROPHENOL	51-28-5	20	0	NA
2,4-DINITROTOLUENE	121-14-2	20	0	NA
2,6-DINITROTOLUENE	606-20-2	20	0	NA
2-CHLORONAPHTHALENE	91-58-7	20	0	NA
2-CHLOROPHENOL	95-57-8	20	0	NA
2-METHYLNAPHTHALENE	91-57-6	20	0	NA
2-METHYLPHENOL	95-48-7	20	0	NA
2-NITROANILINE	88-74-4	20	0	NA
2-NITROPHENOL	88-75-5	20	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	20	0	NA
3-NITROANILINE	99-09-2	20	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	9	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	20	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	20	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	20	0	NA
4-CHLOROANILINE	106-47-8	20	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	20	0	NA
4-METHYLPHENOL	106-44-5	20	0	NA
4-NITROANILINE	100-01-6	20	0	NA
4-NITROPHENOL	100-02-7	20	0	NA
ACENAPHTHENE	83-32-9	20	0	NA
ACENAPHTHYLENE	208-96-8	20	0	NA
ANILINE	62-53-3	12	0	NA
ANTHRACENE	120-12-7	20	0	NA
BENZO(A)ANTHRACENE	56-55-3	20	0	NA
BENZO(A)PYRENE	50-32-8	20	0	NA
BENZO(B)FLUORANTHENE	205-99-2	20	0	NA
BENZO(GHI)PERYLENE	191-24-2	20	0	NA
BENZO(K)FLUORANTHENE	207-08-9	20	0	NA
BENZOIC ACID	65-85-0	8	0	NA
BENZYL ALCOHOL	100-51-6	8	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	20	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	20	0	NA

Table 5-20
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 4^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BIS(2-CHLOROETHYL) ETHER	111-44-4	20	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	20	11	0.84 MG/KG
BISPHENOL A	80-05-7	12	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	20	1	19 UG/KG
CARBAZOLE	86-74-8	12	0	NA
CHRYSENE	218-01-9	20	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	20	13	3812 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	20	1	504 UG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	20	0	NA
DIBENZOFURAN	132-64-9	20	0	NA
DIETHYL PHTHALATE	84-66-2	20	0	NA
DIMETHYL PHTHALATE	131-11-3	20	0	NA
FLUORANTHENE	206-44-0	20	0	NA
FLUORENE	86-73-7	20	0	NA
HEXACHLOROBENZENE	118-74-1	20	0	NA
HEXACHLOROBUTADIENE	87-68-3	20	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	20	0	NA
HEXACHLOROETHANE	67-72-1	20	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	20	0	NA
ISOPHORONE	78-59-1	20	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	20	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	20	0	NA
NAPHTHALENE	91-20-3	20	0	NA
NITROBENZENE	98-95-3	20	0	NA
PENTACHLOROPHENOL	87-86-5	20	0	NA
PHENANTHRENE	85-01-8	20	0	NA
PHENOL	108-95-2	20	0	NA
PYRENE	129-00-0	20	0	NA
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	6	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	6	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	6	0	NA
1,1-DICHLOROETHANE	75-34-3	6	0	NA
1,1-DICHLOROETHENE	75-35-4	6	0	NA
1,2-DICHLOROETHANE	107-06-2	6	0	NA
1,2-DICHLOROPROPANE	78-87-5	6	0	NA
2-BUTANONE	78-93-3	6	0	NA
2-HEXANONE	591-78-6	6	0	NA
4-METHYL-2-PENTANONE	108-10-1	6	0	NA
ACETONE	67-64-1	6	0	NA
BENZENE	71-43-2	6	0	NA
BROMODICHLOROMETHANE	75-27-4	6	0	NA
BROMOFORM	75-25-2	6	0	NA
BROMOMETHANE	74-83-9	6	0	NA
CARBON DISULFIDE	75-15-0	6	0	NA
CARBON TETRACHLORIDE	56-23-5	6	0	NA
CHLOROBENZENE	108-90-7	6	0	NA
CHLOROETHANE	75-00-3	6	0	NA
CHLOROFORM	67-66-3	6	0	NA

Table 5-20
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 4^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CHLOROMETHANE	74-87-3	6	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	6	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	6	0	NA
DIBROMOCHLOROMETHANE	124-48-1	6	0	NA
ETHYLBENZENE	100-41-4	6	0	NA
METHYLENE CHLORIDE	75-09-2	6	3	20 UG/KG
STYRENE	100-42-5	6	0	NA
TETRACHLOROETHENE	127-18-4	6	0	NA
TOLUENE	108-88-3	6	0	NA
TOTAL XYLENES	1330-20-7	6	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	6	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	6	0	NA
TRICHLOROETHYLENE	79-01-6	6	0	NA
VINYL ACETATE	108-05-4	6	0	NA
VINYL CHLORIDE	75-01-4	6	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-21
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 5*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Metals				
ALUMINUM	7429-90-5	3	3	3330 MG/KG
ANTIMONY	7440-36-0	3	0	NA
ARSENIC	7440-38-2	3	3	3.8 MG/KG
BARIUM	7440-39-3	3	3	63.4 MG/KG
BERYLLIUM	7440-41-7	3	0	NA
CADMIUM	7440-43-9	3	0	NA
CHROMIUM	7440-47-3	3	3	24.5 MG/KG
COBALT	7440-48-4	3	3	4.3 MG/KG
COPPER	7440-50-8	3	3	8.6 MG/KG
LEAD	7439-92-1	3	3	3.7 MG/KG
MANGANESE	7439-96-5	3	3	136 MG/KG
MERCURY	7439-97-6	3	0	NA
NICKEL	7440-02-0	3	3	6.4 MG/KG
SELENIUM	7782-49-2	3	0	NA
SILVER	7440-22-4	3	0	NA
THALLIUM	7440-28-0	3	0	NA
VANADIUM	7440-62-2	3	3	22.6 MG/KG
ZINC	7440-66-6	3	3	18.7 MG/KG

Note:

* table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-22
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 6*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	19	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	14	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	7	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	19	0	NA
1,1-DICHLOROETHANE	75-34-3	19	0	NA
1,1-DICHLOROETHENE	75-35-4	19	0	NA
1,2,3-TRICHLOROPROPANE	96-18-4	1	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	7	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	7	0	NA
1,2-DIBROMOETHANE	106-93-4	12	0	NA
1,2-DICHLOROBENZENE	95-50-1	6	0	NA
1,2-DICHLOROETHANE	107-06-2	14	0	NA
1,2-DICHLOROETHYLENE	540-59-0	7	0	NA
1,2-DICHLOROPROPANE	78-87-5	14	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	1	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	7	0	NA
1,3-DICHLOROBENZENE	541-73-1	6	0	NA
1,4-DICHLOROBENZENE	106-46-7	6	0	NA
2-BUTANONE	78-93-3	12	0	NA
2-HEXANONE	591-78-6	13	0	NA
4-METHYL-2-PENTANONE	108-10-1	13	0	NA
ACETONE	67-64-1	7	4	28 PPMV
BENZENE	71-43-2	19	0	NA
BENZYL CHLORIDE	100-44-7	1	0	NA
BROMODICHLOROMETHANE	75-27-4	14	0	NA
BROMOFORM	75-25-2	14	0	NA
BROMOMETHANE	74-83-9	14	0	NA
CARBON DISULFIDE	75-15-0	13	0	NA
CARBON TETRACHLORIDE	56-23-5	19	0	NA
CHLOROBENZENE	108-90-7	14	0	NA
CHLOROETHANE	75-00-3	14	0	NA
CHLOROFORM	67-66-3	19	1	2 PPBV
CHLOROMETHANE	74-87-3	14	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	12	1	9.9 PPBV
CIS-1,3-DICHLOROPROPENE	10061-01-5	14	0	NA
DBCP	96-12-8	6	0	NA
DIBROMOCHLOROMETHANE	124-48-1	19	0	NA
DIBROMOMETHANE	74-95-3	1	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	7	0	NA
ETHYLBENZENE	100-41-4	19	0	NA
HEXACHLOROBUTADIENE	87-68-3	7	0	NA
M,P-XYLENE	7816-60-0	7	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	18	0	NA
METHYLENE CHLORIDE	75-09-2	19	0	NA
NAPHTHALENE	91-20-3	7	0	NA
O-XYLENE	95-47-6	7	0	NA
STYRENE	100-42-5	14	0	NA
TETRACHLOROETHENE	127-18-4	19	1	4.2 PPBV

Table 5-22
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 6*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
TOLUENE	108-88-3	19	1	2 PPBV
TOTAL XYLENES	1330-20-7	12	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	12	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	14	0	NA
TRICHLOROETHYLENE	79-01-6	19	1	2.9 PPBV
TRICHLOROFLUOROMETHANE	75-69-4	7	0	NA
VINYL CHLORIDE	75-01-4	14	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-23
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 6^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Ethylene Glycol				
ETHYLENE GLYCOL	107-21-1	2	0	NA
Fuels				
DIESEL	11-84-7	8	0	NA
Metals				
ALUMINUM	7429-90-5	8	8	11200 MG/KG
ANTIMONY	7440-36-0	8	0	NA
ARSENIC	7440-38-2	8	6	7.1 MG/KG
BARIUM	7440-39-3	8	8	74.8 MG/KG
BERYLLIUM	7440-41-7	8	0	NA
BORON	7440-42-8	8	7	13.3 MG/KG
CADMIUM	7440-43-9	8	0	NA
CHROMIUM	7440-47-3	8	8	14.5 MG/KG
COBALT	7440-48-4	8	7	6.6 MG/KG
COPPER	7440-50-8	8	8	15.6 MG/KG
CYANIDES	57-12-5	8	0	NA
LEAD	7439-92-1	8	8	58.7 MG/KG
MANGANESE	7439-96-5	8	8	251 MG/KG
MERCURY	7439-97-6	8	1	0.14 MG/KG
MOLYBDENUM	7439-98-7	8	0	NA
NICKEL	7440-02-0	8	6	7.9 MG/KG
SELENIUM	7782-49-2	8	2	1.6 MG/KG
SILVER	7440-22-4	8	1	2.5 MG/KG
STRONTIUM	7440-24-6	8	8	104 MG/KG
THALLIUM	7440-28-0	8	2	8.9 MG/KG
VANADIUM	7440-62-2	8	8	44.2 MG/KG
ZINC	7440-66-6	8	8	159 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	7	0	NA
4,4'-DDE	72-55-9	7	4	136.2 UG/KG
4,4'-DDT	50-29-3	7	3	10.04 UG/KG
ALDRIN	309-00-2	7	0	NA
ALPHA-BHC	319-84-6	7	0	NA
ALPHA-CHLORDANE	5103-71-9	7	1	0.82 UG/KG
BETA-BHC	319-85-7	7	0	NA
DELTA-BHC	319-86-8	7	0	NA
DIELDRIN	60-57-1	7	1	2.87 UG/KG
ENDOSULFAN SULFATE	1031-07-8	7	0	NA
ENDOSULFAN-I	959-98-8	7	0	NA
ENDOSULFAN-II	33213-65-9	7	1	0.36 UG/KG
ENDRIN	72-20-8	7	2	0.72 UG/KG
ENDRIN ALDEHYDE	7421-93-4	7	2	1.11 UG/KG
ENDRIN KETONE	53494-70-5	7	1	0.39 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	7	2	0.39 UG/KG
GAMMA-CHLORDANE	5566-34-7	7	1	1.35 UG/KG
HEPTACHLOR	76-44-8	7	1	0.17 UG/KG
HEPTACHLOR EPOXIDE	1024-57-3	7	0	NA
METHOXYCHLOR	72-43-5	7	0	NA
AROCLOR 1016	12674-11-2	14	0	NA

Table 5-23
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 6^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1221	11104-28-2	14	0	NA
AROCLOR 1232	11141-16-5	14	0	NA
AROCLOR 1242	53469-21-9	14	0	NA
AROCLOR 1248	12672-29-6	14	0	NA
AROCLOR 1254	11097-69-1	14	0	NA
AROCLOR 1260	11096-82-5	14	0	NA
TOXAPHENE	8001-35-2	7	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	15	0	NA
1,2-DICHLOROBENZENE	95-50-1	15	0	NA
1,3-DICHLOROBENZENE	541-73-1	15	0	NA
1,4-DICHLOROBENZENE	106-46-7	15	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	15	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	15	0	NA
2,4-DICHLOROPHENOL	120-83-2	15	0	NA
2,4-DIMETHYLPHENOL	105-67-9	15	0	NA
2,4-DINITROPHENOL	51-28-5	15	0	NA
2,4-DINITROTOLUENE	121-14-2	15	0	NA
2,6-DINITROTOLUENE	606-20-2	15	0	NA
2-CHLORONAPHTHALENE	91-58-7	15	0	NA
2-CHLOROPHENOL	95-57-8	15	0	NA
2-METHYLNAPHTHALENE	91-57-6	15	0	NA
2-METHYLPHENOL	95-48-7	15	0	NA
2-NITROANILINE	88-74-4	15	0	NA
2-NITROPHENOL	88-75-5	15	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	15	0	NA
3-NITROANILINE	99-09-2	15	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	5	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	15	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	15	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	15	0	NA
4-CHLOROANILINE	106-47-8	15	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	15	0	NA
4-METHYLPHENOL	106-44-5	15	0	NA
4-NITROANILINE	100-01-6	15	0	NA
4-NITROPHENOL	100-02-7	15	0	NA
ACENAPHTHENE	83-32-9	15	0	NA
ACENAPHTHYLENE	208-96-8	15	0	NA
ANILINE	62-53-3	8	0	NA
ANTHRACENE	120-12-7	15	0	NA
BENZO(A)ANTHRACENE	56-55-3	15	0	NA
BENZO(A)PYRENE	50-32-8	15	0	NA
BENZO(B)FLUORANTHENE	205-99-2	15	0	NA
BENZO(GHI)PERYLENE	191-24-2	15	0	NA
BENZO(K)FLUORANTHENE	207-08-9	15	0	NA
BENZOIC ACID	65-85-0	7	0	NA
BENZYL ALCOHOL	100-51-6	7	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	15	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	15	0	NA

Table 5-23
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 6^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BIS(2-CHLOROETHYL) ETHER	111-44-4	15	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	15	5	155 UG/KG
BISPHENOL A	80-05-7	8	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	15	0	NA
CARBAZOLE	86-74-8	8	0	NA
CHRYSENE	218-01-9	15	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	15	3	272 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	15	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	15	0	NA
DIBENZOFURAN	132-64-9	15	0	NA
DIETHYL PHTHALATE	84-66-2	15	0	NA
DIMETHYL PHTHALATE	131-11-3	15	0	NA
FLUORANTHENE	206-44-0	15	0	NA
FLUORENE	86-73-7	15	0	NA
HEXACHLOROBENZENE	118-74-1	15	0	NA
HEXACHLOROBUTADIENE	87-68-3	15	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	15	0	NA
HEXACHLOROETHANE	67-72-1	15	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	15	0	NA
ISOPHORONE	78-59-1	15	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	15	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	15	0	NA
NAPHTHALENE	91-20-3	15	0	NA
NITROBENZENE	98-95-3	15	0	NA
PENTACHLOROPHENOL	87-86-5	15	0	NA
PHENANTHRENE	85-01-8	15	0	NA
PHENOL	108-95-2	15	0	NA
PYRENE	129-00-0	15	0	NA
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	1	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	1	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	1	0	NA
1,1-DICHLOROETHANE	75-34-3	1	0	NA
1,1-DICHLOROETHENE	75-35-4	1	0	NA
1,2-DICHLOROETHANE	107-06-2	1	0	NA
1,2-DICHLOROETHYLENE	540-59-0	1	0	NA
1,2-DICHLOROPROPANE	78-87-5	1	0	NA
2-BUTANONE	78-93-3	1	0	NA
2-HEXANONE	591-78-6	1	0	NA
4-METHYL-2-PENTANONE	108-10-1	1	0	NA
ACETONE	67-64-1	1	1	30 UG/KG
BENZENE	71-43-2	1	0	NA
BROMODICHLOROMETHANE	75-27-4	1	0	NA
BROMOFORM	75-25-2	1	0	NA
BROMOMETHANE	74-83-9	1	0	NA
CARBON DISULFIDE	75-15-0	1	0	NA
CARBON TETRACHLORIDE	56-23-5	1	0	NA
CHLOROBENZENE	108-90-7	1	0	NA
CHLOROETHANE	75-00-3	1	0	NA

Table 5-23
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 6^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CHLOROFORM	67-66-3	1	0	NA
CHLOROMETHANE	74-87-3	1	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	1	0	NA
DIBROMOCHLOROMETHANE	124-48-1	1	0	NA
ETHYLBENZENE	100-41-4	1	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	1	0	NA
METHYLENE CHLORIDE	75-09-2	1	0	NA
STYRENE	100-42-5	1	0	NA
TETRACHLOROETHENE	127-18-4	1	0	NA
TOLUENE	108-88-3	1	0	NA
TOTAL XYLENES	1330-20-7	1	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	1	0	NA
TRICHLOROETHYLENE	79-01-6	1	0	NA
VINYL CHLORIDE	75-01-4	1	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-24
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 6*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	8	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	8	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	8	0	NA
1,1-DICHLOROETHANE	75-34-3	8	0	NA
1,1-DICHLOROETHENE	75-35-4	8	0	NA
1,2-DICHLOROETHANE	107-06-2	8	0	NA
1,2-DICHLOROETHYLENE	540-59-0	8	0	NA
1,2-DICHLOROPROPANE	78-87-5	8	0	NA
2-HEXANONE	591-78-6	8	0	NA
4-METHYL-2-PENTANONE	108-10-1	8	0	NA
ACETONE	67-64-1	8	0	NA
BENZENE	71-43-2	8	0	NA
BROMODICHLOROMETHANE	75-27-4	8	0	NA
BROMOFORM	75-25-2	8	0	NA
BROMOMETHANE	74-83-9	8	0	NA
CARBON DISULFIDE	75-15-0	8	0	NA
CARBON TETRACHLORIDE	56-23-5	8	0	NA
CHLOROBENZENE	108-90-7	8	0	NA
CHLOROETHANE	75-00-3	8	0	NA
CHLOROFORM	67-66-3	8	0	NA
CHLOROMETHANE	74-87-3	8	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	8	0	NA
DIBROMOCHLOROMETHANE	124-48-1	8	0	NA
ETHYLBENZENE	100-41-4	8	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	8	0	NA
METHYLENE CHLORIDE	75-09-2	8	0	NA
STYRENE	100-42-5	8	0	NA
TETRACHLOROETHENE	127-18-4	8	0	NA
TOLUENE	108-88-3	8	0	NA
TOTAL XYLENES	1330-20-7	8	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	8	0	NA
TRICHLOROETHYLENE	79-01-6	8	0	NA
VINYL CHLORIDE	75-01-4	8	0	NA

Table 5-24
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 6*

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-25
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 7*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1,2-TETRACHLOROETHANE	630-20-6	8	0	NA
1,1,1-TRICHLOROETHANE	71-55-6	20	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	19	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	11	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	20	0	NA
1,1-DICHLOROETHANE	75-34-3	20	0	NA
1,1-DICHLOROETHENE	75-35-4	20	0	NA
1,1-DICHLOROPROPENE	563-58-6	8	0	NA
1,2,3-TRICHLOROBENZENE	87-61-6	8	0	NA
1,2,3-TRICHLOROPROPANE	96-18-4	9	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	19	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	19	1	2 PPBV
1,2-DIBROMOETHANE	106-93-4	20	0	NA
1,2-DICHLOROBENZENE	95-50-1	18	0	NA
1,2-DICHLOROETHANE	107-06-2	19	0	NA
1,2-DICHLOROETHYLENE	540-59-0	8	0	NA
1,2-DICHLOROPROPANE	78-87-5	19	0	NA
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	1	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	19	0	NA
1,3-DICHLOROBENZENE	541-73-1	18	0	NA
1,3-DICHLOROPROPANE	142-28-9	8	0	NA
1,4-DICHLOROBENZENE	106-46-7	18	0	NA
2-BUTANONE	78-93-3	1	0	NA
2-HEXANONE	591-78-6	10	0	NA
4-METHYL-2-PENTANONE	108-10-1	10	0	NA
BENZENE	71-43-2	20	0	NA
BENZYL CHLORIDE	100-44-7	1	0	NA
BROMOBENZENE	108-86-1	8	0	NA
BROMOCHLOROMETHANE	74-97-5	8	0	NA
BROMODICHLOROMETHANE	75-27-4	19	0	NA
BROMOFORM	75-25-2	19	0	NA
BROMOMETHANE	74-83-9	19	0	NA
CARBON DISULFIDE	75-15-0	10	0	NA
CARBON TETRACHLORIDE	56-23-5	20	0	NA
CHLOROBENZENE	108-90-7	19	0	NA
CHLOROETHANE	75-00-3	19	0	NA
CHLOROFORM	67-66-3	20	1	0.2 PPMV
CHLOROMETHANE	74-87-3	19	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	20	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	19	0	NA
CUMENE	98-82-8	8	0	NA
DBCP	96-12-8	18	0	NA
DIBROMOCHLOROMETHANE	124-48-1	20	0	NA
DIBROMOMETHANE	74-95-3	9	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	19	0	NA
ETHYLBENZENE	100-41-4	20	0	NA
HEXACHLOROBUTADIENE	87-68-3	19	0	NA
IODOMETHANE	74-88-4	1	0	NA

Table 5-25
Chemicals Reported in Soil Gas at CAOC 10.38/10.39, Unit 7*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
M,P-XYLENE	7816-60-0	19	1	4 PPBV
METHYL TERT-BUTYL ETHER	1634-04-4	11	0	NA
METHYLENE CHLORIDE	75-09-2	20	5	1.4 PPMV
N-BUTYLBENZENE	104-51-8	8	0	NA
N-PROPYLBENZENE	103-65-1	8	0	NA
NAPHTHALENE	91-20-3	18	1	0.3 PPMV
O-CHLOROTOLUENE	95-49-8	8	0	NA
O-XYLENE	95-47-6	19	1	2 PPBV
P-CHLOROTOLUENE	106-43-4	8	0	NA
P-CYMENE	99-87-6	8	0	NA
SEC-BUTYLBENZENE	135-98-8	8	0	NA
SEC-DICHLOROPROPANE	594-20-7	8	0	NA
STYRENE	100-42-5	19	0	NA
TERT-BUTYLBENZENE	98-06-6	8	0	NA
TETRACHLOROETHENE	127-18-4	20	2	1.2 UG/L
TOLUENE	108-88-3	20	1	4.1 PPBV
TOTAL XYLENES	1330-20-7	1	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	20	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	19	0	NA
TRICHLOROETHYLENE	79-01-6	20	0	NA
TRICHLOROFLUOROMETHANE	75-69-4	19	0	NA
VINYL CHLORIDE	75-01-4	19	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-26
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 7^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Ethylene Glycol				
ETHYLENE GLYCOL	107-21-1	9	0	NA
Fuels				
DIESEL	11-84-7	22	4	78 MG/KG
GASOLINE RANGE ORGANICS	8006-61-9	8	0	NA
MOTOR OIL	68476-77-7	8	4	15 MG/KG
PETROLEUM HYDROCARBONS	10-90-2	2	0	NA
Metals				
ALUMINUM	7429-90-5	22	22	10500 MG/KG
ANTIMONY	7440-36-0	22	1	0.36 MG/KG
ARSENIC	7440-38-2	22	20	5.9 MG/KG
BARIUM	7440-39-3	22	22	224 MG/KG
BERYLLIUM	7440-41-7	29	7	0.83 MG/KG
BORON	7440-42-8	21	16	46.4 MG/KG
CADMIUM	7440-43-9	29	3	3.1 MG/KG
CHROMIUM	7440-47-3	22	22	13.2 MG/KG
COBALT	7440-48-4	22	22	8.2 MG/KG
COPPER	7440-50-8	22	22	20 MG/KG
CYANIDES	57-12-5	21	0	NA
LEAD	7439-92-1	37	37	17.2 MG/KG
MANGANESE	7439-96-5	22	22	1050 MG/KG
MERCURY	7439-97-6	29	1	0.07 MG/KG
MOLYBDENUM	7439-98-7	29	1	4.7 MG/KG
NICKEL	7440-02-0	22	21	12.7 MG/KG
SELENIUM	7782-49-2	22	2	2.5 MG/KG
SILVER	7440-22-4	22	6	3.4 MG/KG
STRONTIUM	7440-24-6	14	14	99.5 MG/KG
THALLIUM	7440-28-0	22	0	NA
VANADIUM	7440-62-2	22	22	38.5 MG/KG
ZINC	7440-66-6	22	22	47 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	17	6	0.89 UG/KG
4,4'-DDE	72-55-9	17	5	18.11 UG/KG
4,4'-DDT	50-29-3	17	2	14.32 UG/KG
ALDRIN	309-00-2	17	1	0.19 UG/KG
ALPHA-BHC	319-84-6	17	0	NA
ALPHA-CHLORDANE	5103-71-9	17	5	0.35 UG/KG
BETA-BHC	319-85-7	10	0	NA
DELTA-BHC	319-86-8	17	0	NA
DIELDRIN	60-57-1	17	0	NA
ENDOSULFAN SULFATE	1031-07-8	17	0	NA
ENDOSULFAN-I	959-98-8	17	0	NA
ENDOSULFAN-II	33213-65-9	17	0	NA
ENDRIN	72-20-8	17	3	0.55 UG/KG
ENDRIN ALDEHYDE	7421-93-4	17	0	NA
ENDRIN KETONE	53494-70-5	17	2	0.97 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	17	0	NA
GAMMA-CHLORDANE	5566-34-7	17	2	0.13 UG/KG
HEPTACHLOR	76-44-8	17	2	0.22 UG/KG

Table 5-26
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 7^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
HEPTACHLOR EPOXIDE	1024-57-3	17	2	0.27 UG/KG
METHOXYCHLOR	72-43-5	17	1	1.22 UG/KG
AROCLOR 1016	12674-11-2	21	0	NA
AROCLOR 1221	11104-28-2	21	0	NA
AROCLOR 1232	11141-16-5	21	0	NA
AROCLOR 1242	53469-21-9	21	0	NA
AROCLOR 1248	12672-29-6	28	0	NA
AROCLOR 1254	11097-69-1	21	0	NA
AROCLOR 1260	11096-82-5	28	2	45 UG/KG
TOXAPHENE	8001-35-2	10	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	31	0	NA
1,2-DICHLOROBENZENE	95-50-1	31	0	NA
1,3-DICHLOROBENZENE	541-73-1	31	0	NA
1,4-DICHLOROBENZENE	106-46-7	31	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	31	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	31	0	NA
2,4-DICHLOROPHENOL	120-83-2	31	0	NA
2,4-DIMETHYLPHENOL	105-67-9	31	0	NA
2,4-DINITROPHENOL	51-28-5	31	0	NA
2,4-DINITROTOLUENE	121-14-2	31	0	NA
2,6-DINITROTOLUENE	606-20-2	31	0	NA
2-CHLORONAPHTHALENE	91-58-7	31	0	NA
2-CHLOROPHENOL	95-57-8	31	0	NA
2-METHYLNAPHTHALENE	91-57-6	31	0	NA
2-METHYLPHENOL	95-48-7	31	0	NA
2-NITROANILINE	88-74-4	31	0	NA
2-NITROPHENOL	88-75-5	31	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	31	0	NA
3-NITROANILINE	99-09-2	31	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	14	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	31	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	31	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	31	0	NA
4-CHLOROANILINE	106-47-8	31	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	31	0	NA
4-METHYLPHENOL	106-44-5	31	0	NA
4-NITROANILINE	100-01-6	31	0	NA
4-NITROPHENOL	100-02-7	31	0	NA
ACENAPHTHENE	83-32-9	31	0	NA
ACENAPHTHYLENE	208-96-8	31	0	NA
ANILINE	62-53-3	14	0	NA
ANTHRACENE	120-12-7	31	0	NA
BENZO(A)ANTHRACENE	56-55-3	31	0	NA
BENZO(A)PYRENE	50-32-8	31	0	NA
BENZO(B)FLUORANTHENE	205-99-2	31	0	NA
BENZO(GHI)PERYLENE	191-24-2	31	0	NA
BENZO(K)FLUORANTHENE	207-08-9	31	0	NA
BENZOIC ACID	65-85-0	9	0	NA

Table 5-26
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 7^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BENZYL ALCOHOL	100-51-6	9	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	31	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	31	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	31	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	37	15	0.73 MG/KG
BISPHENOL A	80-05-7	14	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	31	1	38 UG/KG
CARBAZOLE	86-74-8	22	0	NA
CHRYSENE	218-01-9	37	2	39 UG/KG
DI-N-BUTYL PHTHALATE	84-74-2	37	6	315 UG/KG
DI-N-OCTYL PHTHALATE	117-84-0	37	1	0.03 MG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	31	0	NA
DIBENZOFURAN	132-64-9	37	1	27 UG/KG
DIETHYL PHTHALATE	84-66-2	31	0	NA
DIMETHYL PHTHALATE	131-11-3	31	0	NA
FLUORANTHENE	206-44-0	37	2	117 UG/KG
FLUORENE	86-73-7	31	0	NA
HEXACHLOROENZENE	118-74-1	31	0	NA
HEXACHLOROBUTADIENE	87-68-3	31	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	31	0	NA
HEXACHLOROETHANE	67-72-1	31	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	31	0	NA
ISOPHORONE	78-59-1	31	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	31	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	37	0	NA
NAPHTHALENE	91-20-3	31	0	NA
NITROBENZENE	98-95-3	31	0	NA
PENTACHLOROPHENOL	87-86-5	31	0	NA
PHENANTHRENE	85-01-8	37	2	262 UG/KG
PHENOL	108-95-2	37	0	NA
PYRENE	129-00-0	37	3	93 UG/KG
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	26	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	26	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	26	0	NA
1,1-DICHLOROETHANE	75-34-3	26	0	NA
1,1-DICHLOROETHENE	75-35-4	26	0	NA
1,2-DICHLOROETHANE	107-06-2	26	0	NA
1,2-DICHLOROETHYLENE	540-59-0	10	0	NA
1,2-DICHLOROPROPANE	78-87-5	26	0	NA
2-BUTANONE	78-93-3	33	0	NA
2-HEXANONE	591-78-6	26	0	NA
4-METHYL-2-PENTANONE	108-10-1	26	0	NA
ACETONE	67-64-1	33	14	64 UG/KG
BENZENE	71-43-2	26	0	NA
BROMODICHLOROMETHANE	75-27-4	26	0	NA
BROMOFORM	75-25-2	26	0	NA
BROMOMETHANE	74-83-9	26	0	NA
CARBON DISULFIDE	75-15-0	26	0	NA

Table 5-26
Chemicals Reported in Soil at CAOC 10.38/10.39, Unit 7^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
CARBON TETRACHLORIDE	56-23-5	26	0	NA
CHLOROBENZENE	108-90-7	26	0	NA
CHLOROETHANE	75-00-3	26	0	NA
CHLOROFORM	67-66-3	33	2	3 UG/KG
CHLOROMETHANE	74-87-3	26	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	16	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	26	0	NA
DIBROMOCHLOROMETHANE	124-48-1	26	0	NA
ETHYLBENZENE	100-41-4	26	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	10	0	NA
METHYLENE CHLORIDE	75-09-2	33	5	19 UG/KG
STYRENE	100-42-5	26	0	NA
TETRACHLOROETHENE	127-18-4	26	0	NA
TOLUENE	108-88-3	33	3	2 UG/KG
TOTAL XYLENES	1330-20-7	33	1	2 UG/KG
TRANS-1,2-DICHLOROETHENE	156-60-5	16	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	26	0	NA
TRICHLOROETHYLENE	79-01-6	26	0	NA
VINYL ACETATE	108-05-4	16	0	NA
VINYL CHLORIDE	75-01-4	26	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPA – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-27
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 7*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1,2-TETRACHLOROETHANE	630-20-6	9	0	NA
1,1,1-TRICHLOROETHANE	71-55-6	15	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	15	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	15	0	NA
1,1-DICHLOROETHANE	75-34-3	15	0	NA
1,1-DICHLOROETHENE	75-35-4	15	0	NA
1,1-DICHLOROPROPENE	563-58-6	9	0	NA
1,2,3-TRICHLOROBENZENE	87-61-6	9	0	NA
1,2,3-TRICHLOROPROPANE	96-18-4	9	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	9	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	9	0	NA
1,2-DIBROMOETHANE	106-93-4	9	0	NA
1,2-DICHLOROBENZENE	95-50-1	9	0	NA
1,2-DICHLOROETHANE	107-06-2	15	0	NA
1,2-DICHLOROETHYLENE	540-59-0	6	0	NA
1,2-DICHLOROPROPANE	78-87-5	15	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	9	0	NA
1,3-DICHLOROBENZENE	541-73-1	9	0	NA
1,3-DICHLOROPROPANE	142-28-9	9	0	NA
1,4-DICHLOROBENZENE	106-46-7	9	0	NA
1-CHLOROHEXANE	544-10-5	9	0	NA
2-HEXANONE	591-78-6	6	0	NA
4-METHYL-2-PENTANONE	108-10-1	6	0	NA
ACETONE	67-64-1	6	0	NA
BENZENE	71-43-2	15	0	NA
BROMOBENZENE	108-86-1	9	0	NA
BROMOCHLOROMETHANE	74-97-5	9	0	NA
BROMODICHLOROMETHANE	75-27-4	15	2	0.68 UG/KG
BROMOFORM	75-25-2	15	2	2.6 UG/KG
BROMOMETHANE	74-83-9	15	0	NA
CARBON DISULFIDE	75-15-0	6	0	NA
CARBON TETRACHLORIDE	56-23-5	15	0	NA
CHLOROBENZENE	108-90-7	15	0	NA
CHLOROETHANE	75-00-3	15	0	NA
CHLOROFORM	67-66-3	15	5	0.93 UG/KG
CHLOROMETHANE	74-87-3	15	1	0.33 UG/KG
CIS-1,2-DICHLOROETHENE	156-59-2	9	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	15	0	NA
CUMENE	98-82-8	9	0	NA
DBCP	96-12-8	9	0	NA
DIBROMOCHLOROMETHANE	124-48-1	15	3	2 UG/KG
DIBROMOMETHANE	74-95-3	9	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	9	0	NA
ETHYLBENZENE	100-41-4	15	0	NA
HEXACHLOROBUTADIENE	87-68-3	9	0	NA
M,P-XYLENE	7816-60-0	9	0	NA
METHYL TERT-BUTYL ETHER	1634-04-4	6	0	NA
METHYLENE CHLORIDE	75-09-2	15	0	NA

Table 5-27
Chemicals Reported in Groundwater at CAOC 10.38/10.39, Unit 7*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
N-BUTYLBENZENE	104-51-8	9	0	NA
N-PROPYLBENZENE	103-65-1	9	0	NA
NAPHTHALENE	91-20-3	9	1	0.38 UG/KG
O-CHLOROTOLUENE	95-49-8	9	0	NA
O-XYLENE	95-47-6	9	0	NA
P-CHLOROTOLUENE	106-43-4	9	0	NA
P-CYMENE	99-87-6	9	0	NA
SEC-BUTYLBENZENE	135-98-8	9	0	NA
SEC-DICHLOROPROPANE	594-20-7	9	0	NA
STYRENE	100-42-5	15	0	NA
TERT-BUTYLBENZENE	98-06-6	9	0	NA
TETRACHLOROETHENE	127-18-4	15	5	1.6 UG/KG
TOLUENE	108-88-3	15	0	NA
TOTAL XYLENES	1330-20-7	6	0	NA
TRANS-1,2-DICHLOROETHENE	156-60-5	9	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	15	0	NA
TRICHLOROETHYLENE	79-01-6	15	5	25.5 UG/KG
TRICHLOROFLUOROMETHANE	75-69-4	9	0	NA
VINYL CHLORIDE	75-01-4	15	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-28
Chemicals Reported in Soil at CAOC N-2 Area 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Fuels				
DIESEL	11-84-7	3	0	NA
Metals				
ALUMINUM	7429-90-5	3	3	10000 MG/KG
ANTIMONY	7440-36-0	3	0	NA
ARSENIC	7440-38-2	3	3	5.9 MG/KG
BARIUM	7440-39-3	3	3	111 MG/KG
BERYLLIUM	7440-41-7	3	0	NA
BORON	7440-42-8	3	3	15.9 MG/KG
CADMIUM	7440-43-9	3	1	1.1 MG/KG
CHROMIUM	7440-47-3	3	3	14.2 MG/KG
COBALT	7440-48-4	3	3	4.8 MG/KG
COPPER	7440-50-8	3	3	19.1 MG/KG
CYANIDES	57-12-5	3	0	NA
LEAD	7439-92-1	3	3	30.7 MG/KG
MANGANESE	7439-96-5	3	3	264 MG/KG
MERCURY	7439-97-6	3	0	NA
MOLYBDENUM	7439-98-7	3	0	NA
NICKEL	7440-02-0	3	3	9.9 MG/KG
SELENIUM	7782-49-2	3	0	NA
SILVER	7440-22-4	3	3	2.6 MG/KG
STRONTIUM	7440-24-6	3	3	125 MG/KG
THALLIUM	7440-28-0	3	0	NA
VANADIUM	7440-62-2	3	3	32.5 MG/KG
ZINC	7440-66-6	3	3	59.6 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	3	2	4.86 UG/KG
4,4'-DDE	72-55-9	3	1	6.22 UG/KG
4,4'-DDT	50-29-3	3	1	2.66 UG/KG
ALDRIN	309-00-2	3	2	0.66 UG/KG
ALPHA-BHC	319-84-6	3	0	NA
ALPHA-CHLORDANE	5103-71-9	3	3	8.44 UG/KG
BETA-BHC	319-85-7	3	0	NA
DELTA-BHC	319-86-8	3	0	NA
DIELDRIN	60-57-1	3	1	9.37 UG/KG
ENDOSULFAN SULFATE	1031-07-8	3	0	NA
ENDOSULFAN-I	959-98-8	3	0	NA
ENDOSULFAN-II	33213-65-9	3	1	1.14 UG/KG
ENDRIN	72-20-8	3	1	2.44 UG/KG
ENDRIN ALDEHYDE	7421-93-4	3	1	4.97 UG/KG
ENDRIN KETONE	53494-70-5	3	2	2.54 UG/KG
GAMMA-BHC (LINDANE)	58-89-9	3	1	0.33 UG/KG
GAMMA-CHLORDANE	5566-34-7	3	1	0.76 UG/KG
HEPTACHLOR	76-44-8	3	0	NA
HEPTACHLOR EPOXIDE	1024-57-3	3	0	NA
METHOXYCHLOR	72-43-5	3	2	12.19 UG/KG
AROCLOR 1016	12674-11-2	17	0	NA
AROCLOR 1221	11104-28-2	17	0	NA
AROCLOR 1232	11141-16-5	17	0	NA

Table 5-28
Chemicals Reported in Soil at CAOC N-2 Area 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
AROCLOR 1242	53469-21-9	17	0	NA
AROCLOR 1248	12672-29-6	17	0	NA
AROCLOR 1254	11097-69-1	17	2	318.14 UG/KG
AROCLOR 1260	11096-82-5	17	0	NA
TOXAPHENE	8001-35-2	3	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	17	0	NA
1,2-DICHLOROBENZENE	95-50-1	17	0	NA
1,3-DICHLOROBENZENE	541-73-1	17	0	NA
1,4-DICHLOROBENZENE	106-46-7	17	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	17	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	17	0	NA
2,4-DICHLOROPHENOL	120-83-2	17	0	NA
2,4-DIMETHYLPHENOL	105-67-9	17	0	NA
2,4-DINITROPHENOL	51-28-5	17	0	NA
2,4-DINITROTOLUENE	121-14-2	17	0	NA
2,6-DINITROTOLUENE	606-20-2	17	0	NA
2-CHLORONAPHTHALENE	91-58-7	17	0	NA
2-CHLOROPHENOL	95-57-8	17	0	NA
2-METHYLNAPHTHALENE	91-57-6	17	0	NA
2-METHYLPHENOL	95-48-7	17	0	NA
2-NITROANILINE	88-74-4	17	0	NA
2-NITROPHENOL	88-75-5	17	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	17	0	NA
3-NITROANILINE	99-09-2	17	0	NA
4,4'-METHYLENE DIANILINE	101-77-9	3	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	17	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	17	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	17	0	NA
4-CHLOROANILINE	106-47-8	17	0	NA
4-CHLOROPHENYLPHENYL ETHER	7005-72-3	17	0	NA
4-METHYLPHENOL	106-44-5	17	0	NA
4-NITROANILINE	100-01-6	17	0	NA
4-NITROPHENOL	100-02-7	17	0	NA
ACENAPHTHENE	83-32-9	17	3	3.4 MG/KG
ACENAPHTHYLENE	208-96-8	17	0	NA
ANILINE	62-53-3	3	0	NA
ANTHRACENE	120-12-7	17	5	9.3 MG/KG
BENZO(A)ANTHRACENE	56-55-3	17	6	150 MG/KG
BENZO(A)PYRENE	50-32-8	17	8	180 MG/KG
BENZO(B)FLUORANTHENE	205-99-2	17	8	140 MG/KG
BENZO(GHI)PERYLENE	191-24-2	17	7	130 MG/KG
BENZO(K)FLUORANTHENE	207-08-9	17	6	110 MG/KG
BENZOIC ACID	65-85-0	4	0	NA
BENZYL ALCOHOL	100-51-6	4	0	NA
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	17	0	NA
BIS(2-CHLOROETHOXY)METHANE	111-91-1	17	0	NA
BIS(2-CHLOROETHYL) ETHER	111-44-4	17	0	NA
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	17	5	1346 UG/KG

Table 5-28
Chemicals Reported in Soil at CAOC N-2 Area 1^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
BISPHENOL A	80-05-7	3	0	NA
BUTYL BENZYL PHTHALATE	85-68-7	17	1	20 UG/KG
CARBAZOLE	86-74-8	13	1	2136 UG/KG
CHRYSENE	218-01-9	17	8	150 MG/KG
DI-N-BUTYL PHTHALATE	84-74-2	17	0	NA
DI-N-OCTYL PHTHALATE	117-84-0	17	0	NA
DIBENZ(A,H)ANTHRACENE	53-70-3	17	7	52 MG/KG
DIBENZOFURAN	132-64-9	17	2	0.25 MG/KG
DIETHYL PHTHALATE	84-66-2	17	0	NA
DIMETHYL PHTHALATE	131-11-3	17	0	NA
FLUORANTHENE	206-44-0	17	8	130 MG/KG
FLUORENE	86-73-7	17	3	0.8 MG/KG
HEXACHLOROBENZENE	118-74-1	17	0	NA
HEXACHLOROBUTADIENE	87-68-3	17	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	17	0	NA
HEXACHLOROETHANE	67-72-1	17	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	17	7	110 MG/KG
ISOPHORONE	78-59-1	17	0	NA
N-NITROSODI-N-PROPYLAMINE	621-64-7	17	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	17	0	NA
NAPHTHALENE	91-20-3	17	2	0.31 MG/KG
NITROBENZENE	98-95-3	17	0	NA
PENTACHLOROPHENOL	87-86-5	17	0	NA
PHENANTHRENE	85-01-8	17	7	23 MG/KG
PHENOL	108-95-2	17	0	NA
PYRENE	129-00-0	17	8	170 MG/KG

Table 5-28
Chemicals Reported in Soil at CAOC N-2 Area 1^{a,b}

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

CAS – Chemical Abstracts Service

2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-29
Chemicals Reported in Soil Gas at CAOC 10*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Volatile Organic Compounds				
1,1,1-TRICHLOROETHANE	71-55-6	48	0	NA
1,1,2,2-TETRACHLOROETHANE	79-34-5	48	0	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	48	0	NA
1,1,2-TRICHLOROETHANE	79-00-5	48	0	NA
1,1-DICHLOROETHANE	75-34-3	48	0	NA
1,1-DICHLOROETHENE	75-35-4	48	0	NA
1,2,4-TRICHLOROBENZENE	120-82-1	48	0	NA
1,2,4-TRIMETHYLBENZENE	95-63-6	48	0	NA
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	48	0	NA
1,2-DIBROMOETHANE	106-93-4	48	0	NA
1,2-DICHLOROBENZENE	95-50-1	48	0	NA
1,2-DICHLOROETHANE	107-06-2	48	0	NA
1,2-DICHLOROPROPANE	78-87-5	48	0	NA
1,3,5-TRIMETHYLBENZENE	108-67-8	48	0	NA
1,3-DICHLOROBENZENE	541-73-1	48	0	NA
1,4-DICHLOROBENZENE	106-46-7	48	0	NA
2-BUTANONE	78-93-3	8	0	NA
2-HEXANONE	591-78-6	48	0	NA
4-METHYL-2-PENTANONE	108-10-1	48	0	NA
ACETONE	67-64-1	8	0	NA
BENZENE	71-43-2	48	0	NA
BROMODICHLOROMETHANE	75-27-4	48	0	NA
BROMOFORM	75-25-2	48	0	NA
BROMOMETHANE	74-83-9	48	0	NA
CARBON DISULFIDE	75-15-0	48	0	NA
CARBON TETRACHLORIDE	56-23-5	48	0	NA
CHLOROBENZENE	108-90-7	48	0	NA
CHLORODIBROMOMETHANE	124-48-1	48	0	NA
CHLOROETHANE	75-00-3	48	0	NA
CHLOROFORM	67-66-3	48	0	NA
CHLOROMETHANE	74-87-3	48	0	NA
CIS-1,2-DICHLOROETHENE	156-59-2	48	0	NA
CIS-1,3-DICHLOROPROPENE	10061-01-5	48	0	NA
DICHLORODIFLUOROMETHANE	75-71-8	48	0	NA
ETHYLBENZENE	100-41-4	48	0	NA
HEXACHLOROBUTADIENE	87-68-3	48	0	NA
META-, PARA-XYLENE	7816-60-0	48	6	0.98 UG/L
METHYL TERT-BUTYL ETHER	1634-04-4	48	0	NA
METHYLENE CHLORIDE	75-09-2	48	0	NA
NAPHTHALENE	91-20-3	48	0	NA
O-XYLENE	95-47-6	48	0	NA
STYRENE	100-42-5	48	0	NA
TETRACHLOROETHENE	127-18-4	48	0	NA
TOLUENE	108-88-3	48	13	1.6 UG/L
TRANS-1,2-DICHLOROETHENE	156-60-5	48	0	NA
TRANS-1,3-DICHLOROPROPENE	10061-02-6	48	0	NA
TRICHLOROETHENE	79-01-6	48	0	NA

Table 5-29
Chemicals Reported in Soil Gas at CAOC 10*

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
TRICHLOROFLUOROMETHANE	75-69-4	48	0	NA
VINYL CHLORIDE	75-01-4	48	0	NA

Note:

* table does not include tentatively identified compounds

Acronyms/Abbreviations:

BHC – benzene hexachloride
CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern
CAS – Chemical Abstracts Service
2,4-D – (2,4-dichlorophenoxy)-acetic acid
2,4-DB – 4-(2,4-dichlorophenoxy)-butanoic acid
DBCP – 1,2-dibromo-3-chloropropane
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethene
DDT – dichlorodiphenyltrichloroethane
UG/KG – micrograms per kilogram
UG/L – micrograms per liter
MCPA – 2-methyl-4-chlorophenoxyacetic acid
MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
MG/KG – milligrams per kilogram
NA – not applicable
PCB – polychlorinated biphenyl
PG/G – picograms per gram
PPBV – parts per billion per volume
PPMV – parts per million per volume
2,4,5-T – 2,4,5-trichlorophenoxyacetic acid
2,4,5-TP – silvex acid

Table 5-30
Chemicals Reported in Soil at CAOC 10^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
Dioxin/Furan				
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-P-DIOXIN	3268-87-9	109	13	120 PG/G
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	39001-02-0	109	3	8 PG/G
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	35822-46-9	109	8	15 PG/G
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	67562-39-4	109	4	11 PG/G
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	55673-89-7	109	0	NA
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	39227-28-6	109	0	NA
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	70648-26-9	109	0	NA
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	57653-85-7	109	0	NA
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	57117-44-9	109	0	NA
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	19408-74-3	109	0	NA
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	72918-21-9	109	0	NA
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	40321-76-4	109	0	NA
1,2,3,7,8-PENTACHLORODIBENZOFURAN	57117-41-6	109	0	NA
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	60851-34-5	109	0	NA
2,3,4,7,8-PENTACHLORODIBENZOFURAN	57117-31-4	109	0	NA
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	1746-01-6	109	0	NA
2,3,7,8-TETRACHLORODIBENZOFURAN	51207-31-9	109	1	0.62 PG/G
HEPTACHLORODIBENZO-P-DIOXINS	37871-00-4	109	8	37 PG/G
HEPTACHLORODIBENZOFURANS	38998-75-3	109	6	19 PG/G
HEXACHLORODIBENZO-P-DIOXINS	34465-46-8	109	1	3.8 PG/G
HEXACHLORODIBENZOFURANS	55684-94-1	109	4	7.8 PG/G
PENTACHLORODIBENZO-P-DIOXINS	36088-22-9	109	0	NA
PENTACHLORODIBENZOFURANS	30402-15-4	109	2	4.4 PG/G
TETRACHLORODIBENZO-P-DIOXINS	41903-57-5	109	0	NA
TETRACHLORODIBENZOFURANS	55722-27-5	109	4	10 PG/G
Herbicides				
2,4'-DB	94-82-6	108	0	NA
2,4,5-T	93-76-5	108	0	NA
2,4,5-TP	93-72-1	108	0	NA
DALAPON	75-99-0	108	0	NA
DICAMBA	1918-00-9	108	10	200 UG/KG
DICHLOROPHENOXYACETIC ACID	94-75-7	108	0	NA
DICHLOROPROP	120-36-5	108	0	NA
DINOSEB	88-85-7	108	0	NA
MCPA	94-74-6	108	0	NA
MCPP	7085-19-0	108	0	NA
Metals				
ALUMINUM	7429-90-5	108	108	16500 MG/KG
ANTIMONY	7440-36-0	96	1	0.9 MG/KG
ARSENIC	7440-38-2	108	108	8.5 MG/KG
BARIUM	7440-39-3	108	108	129 MG/KG
BERYLLIUM	7440-41-7	108	34	0.8 MG/KG
CADMIUM	7440-43-9	108	0	NA
CHROMIUM	7440-47-3	108	108	28.9 MG/KG
COBALT	7440-48-4	108	108	11.6 MG/KG
COPPER	7440-50-8	108	108	22.7 MG/KG
LEAD	7439-92-1	108	108	1100 MG/KG
MANGANESE	7439-96-5	108	108	628 MG/KG

Table 5-30
Chemicals Reported in Soil at CAOC 10^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
MERCURY	7439-97-6	108	0	NA
NICKEL	7440-02-0	108	108	15.5 MG/KG
SELENIUM	7782-49-2	108	6	1.2 MG/KG
SILVER	7440-22-4	108	0	NA
THALLIUM	7440-28-0	108	0	NA
VANADIUM	7440-62-2	108	108	62.9 MG/KG
ZINC	7440-66-6	108	108	108 MG/KG
Pesticides/PCB				
4,4'-DDD	72-54-8	105	0	NA
4,4'-DDE	72-55-9	105	7	0.005 MG/KG
4,4'-DDT	50-29-3	105	0	NA
ALDRIN	309-00-2	105	0	NA
ALPHA-BHC	319-84-6	105	2	0.0093 MG/KG
ALPHA-CHLORDANE	5103-71-9	105	0	NA
AROCLOR 1016	12674-11-2	105	0	NA
AROCLOR 1221	11104-28-2	105	0	NA
AROCLOR 1232	11141-16-5	105	0	NA
AROCLOR 1242	53469-21-9	105	0	NA
AROCLOR 1248	12672-29-6	105	0	NA
AROCLOR 1254	11097-69-1	105	0	NA
AROCLOR 1260	11096-82-5	105	0	NA
BETA-BHC	319-85-7	105	0	NA
DELTA-BHC	319-86-8	105	0	NA
DIELDRIN	60-57-1	105	2	0.003 MG/KG
ENDOSULFAN I	959-98-8	105	3	0.003 MG/KG
ENDOSULFAN II	33213-65-9	105	0	NA
ENDOSULFAN SULFATE	1031-07-8	105	1	0.0003 MG/KG
ENDRIN	72-20-8	105	0	NA
ENDRIN ALDEHYDE	7421-93-4	105	0	NA
ENDRIN KETONE	53494-70-5	105	0	NA
GAMMA-BHC (LINDANE)	58-89-9	105	0	NA
GAMMA-CHLORDANE	5566-34-7	105	3	0.003 MG/KG
HEPTACHLOR	76-44-8	105	1	0.00042 MG/KG
HEPTACHLOR EPOXIDE	1024-57-3	105	0	NA
METHOXYCHLOR	72-43-5	105	0	NA
TOXAPHENE	8001-35-2	105	0	NA
Semivolatile Organic Compounds				
1,2,4-TRICHLOROBENZENE	120-82-1	107	0	NA
1,2-DICHLOROBENZENE	95-50-1	107	0	NA
1,3-DICHLOROBENZENE	541-73-1	107	0	NA
1,4-DICHLOROBENZENE	106-46-7	107	0	NA
2,4,5-TRICHLOROPHENOL	95-95-4	104	0	NA
2,4,6-TRICHLOROPHENOL	88-06-2	104	0	NA
2,4-DICHLOROPHENOL	120-83-2	104	0	NA
2,4-DIMETHYLPHENOL	105-67-9	104	0	NA
2,4-DINITROPHENOL	51-28-5	104	0	NA
2,4-DINITROTOLUENE	121-14-2	107	0	NA
2,6-DINITROTOLUENE	606-20-2	107	0	NA
2-CHLORONAPHTHALENE	91-58-7	107	0	NA

Table 5-30
Chemicals Reported in Soil at CAOC 10^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
2-CHLOROPHENOL	95-57-8	104	0	NA
2-METHYLNAPHTHALENE	91-57-6	107	0	NA
2-METHYLPHENOL	95-48-7	104	0	NA
2-NITROANILINE	88-74-4	107	0	NA
2-NITROPHENOL	88-75-5	104	0	NA
3,3'-DICHLOROBENZIDINE	91-94-1	107	0	NA
3-NITROANILINE	99-09-2	107	0	NA
4,6-DINITRO-2-METHYLPHENOL	534-52-1	104	0	NA
4-BROMOPHENYL PHENYL ETHER	101-55-3	107	0	NA
4-CHLORO-3-METHYLPHENOL	59-50-7	104	0	NA
4-CHLOROANILINE	106-47-8	107	0	NA
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	107	0	NA
4-METHYLPHENOL	106-44-5	104	0	NA
4-NITROANILINE	100-01-6	107	0	NA
4-NITROPHENOL	100-02-7	104	0	NA
ACENAPHTHENE	83-32-9	107	0	NA
ACENAPHTHYLENE	208-96-8	107	0	NA
ANTHRACENE	120-12-7	107	0	NA
BENZ(A)ANTHRACENE	56-55-3	107	0	NA
BENZO(A)PYRENE	50-32-8	107	0	NA
BENZO(B)FLUORANTHENE	205-99-2	107	0	NA
BENZO(G,H,I)PERYLENE	191-24-2	107	0	NA
BENZO(K)FLUORANTHENE	207-08-9	107	0	NA
BENZOIC ACID	65-85-0	104	2	0.07 MG/KG
BENZYL ALCOHOL	100-51-6	107	3	0.13 MG/KG
BIS(2-CHLOROETHOXY)METHANE	111-91-1	107	0	NA
BIS(2-CHLOROETHYL)ETHER	111-44-4	107	0	NA
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9	107	0	NA
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	107	30	0.61 MG/KG
BUTYL BENZYL PHTHALATE	85-68-7	107	1	0.066 MG/KG
CHRYSENE	218-01-9	107	0	NA
DI-N-BUTYL PHTHALATE	84-74-2	107	1	0.043 MG/KG
DI-N-OCTYL PHTHALATE	117-84-0	107	13	0.41 MG/KG
DIBENZ(A,H)ANTHRACENE	53-70-3	107	0	NA
DIBENZOFURAN	132-64-9	107	0	NA
DIETHYL PHTHALATE	84-66-2	107	6	0.094 MG/KG
DIMETHYL PHTHALATE	131-11-3	107	0	NA
FLUORANTHENE	206-44-0	107	0	NA
FLUORENE	86-73-7	107	0	NA
HEXACHLOROBENZENE	118-74-1	107	0	NA
HEXACHLOROBUTADIENE	87-68-3	107	0	NA
HEXACHLOROCYCLOPENTADIENE	77-47-4	107	0	NA
HEXACHLOROETHANE	67-72-1	107	0	NA
INDENO(1,2,3-CD)PYRENE	193-39-5	107	0	NA
ISOPHORONE	78-59-1	107	0	NA
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	107	0	NA
N-NITROSODIPHENYLAMINE	86-30-6	107	0	NA
NAPHTHALENE	91-20-3	107	0	NA
NITROBENZENE	98-95-3	107	0	NA

Table 5-30
Chemicals Reported in Soil at CAOC 10^{a,b}

Analyte Name	Analyte ID	Number of Samples	Number of Detections	Maximum Concentration
PENTACHLOROPHENOL	87-86-5	104	0	NA
PHENANTHRENE	85-01-8	107	0	NA
PHENOL	108-95-2	104	1	0.32 MG/KG
PYRENE	129-00-0	107	0	NA

Notes:

^a table does not include tentatively identified compounds

^b table does not include the five essential nutrients (calcium, iron, magnesium, potassium, and sodium)

Acronyms/Abbreviations:

alpha-BHC – alpha isomer of benzene hexachloride

beta-BHC – beta isomer of benzene hexachloride

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

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2,4-D – (2,4-dichlorophenoxy)-acetic acid

2,4' -DB – 4-(2,4-dichlorophenoxy)-butanoic acid

DBCP – 1,2-dibromo-3-chloropropane

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethene

DDT – dichlorodiphenyltrichloroethane

delta-BHC – delta isomer of benzene hexachloride

gamma-BHC – gamma isomer of benzene hexachloride

UG/KG – micrograms per kilogram

UG/L – micrograms per liter

MCPA – 2-methyl-4-chlorophenoxyacetic acid

MCPA – 2-(2-methyl-4-chlorophenoxy)-propionic acid

MG/KG – milligrams per kilogram

NA – not applicable

PCB – polychlorinated biphenyl

PG/G – picograms per gram

PPBV – parts per billion per volume

PPMV – parts per million per volume

2,4,5-T – 2,4,5-trichlorophenoxyacetic acid

2,4,5-TP – silvex acid

Table 5-31
Physicochemical Properties of Selected Organic Compounds at OU 7 CAOCs

Analytes	Molecular Weight (g/mol)	Water Solubility (mg/L)	Vapor Pressure at 25 °C (mm Hg)	Henry's Law Constant (atm-m ³ /mole) ^a	K _{oc} ^a (L/kg)	Half-Life in Soil ^b (in years)	Half-Life in Groundwater ^{c,d} (in years)
Volatile Organic Compounds							
Bromodichloromethane	168.83	6,740	50	0.0016	55	0.55	— ^e
Bromoform	252.73 ^c	3,100 ^c	5.4 ^c	5.34 × 10 ⁻⁴	87.1	1	—
Chlorodibromomethane	208.28 ^b	2,700 ^c	5.54 ^c	7.83 × 10 ⁻⁴	63.1	0.49	—
Chloroform	119.39	7,950	246	0.00366	39.8	0.15	—
Chloromethane	50.49 ^c	5,320 ^c	4,300 ^c	0.00882	6	—	NR
Naphthalene	128	31	—	4.83 × 10 ⁻⁴	2,000	0.71	—
Tetrachloroethene	165.82	150.3	18.49	0.0184	155	0.99	—
Toluene	92.13	534.8	28.4	0.00663	182	0.06	3.8
Trichloroethene	131.4	1,100	69	0.0103	166	0.99	6.3
Semivolatile Organic Compounds							
Benz(a)anthracene	228	0.014	3.05 × 10 ⁻⁸	3.34 × 10 ⁻⁶	3.98 × 10 ⁵	1.86	NR ^f
Benzo(a)pyrene	252.3	0.0038	5.49 × 10 ⁻⁹	1.13 × 10 ⁻⁶	1.02 × 10 ⁶	1.45	NR
Benzo(b)fluoranthene	252	0.014	5.0 × 10 ⁻⁷	1.11 × 10 ⁻⁴	1.23 × 10 ⁶	1.67	NR
Benzo(k)fluoranthene	252	0.0043	2.0 × 10 ⁻⁹	8.29 × 10 ⁻⁷	1.23 × 10 ⁶	5.86	NR
Chrysene	228	0.006	—	9.46 × 10 ⁻⁵	3.98 × 10 ⁵	2.72	NR
Dibenz(a,h)anthracene	278	0.0025	1.0 × 10 ⁻¹⁰	1.47 × 10 ⁻⁸	3.8 × 10 ⁶	2.58	NR
Indeno(1,2,3-c,d)pyrene	276	5.3 × 10 ⁻⁴	1.0 × 10 ⁻¹⁰	1.6 × 10 ⁻⁶	3.47 × 10 ⁶	2.0	NR
Pesticides and Polychlorinated Biphenyls							
Aroclor 1254	327–328.4	0.07	—	—	3.09 × 10 ⁵	1.2 × 10 ⁵	NR
Aroclor 1260	372–375.7	0.003	— ^c	—	3.47 × 10 ⁵	4.1 × 10 ⁵	NR
Dieldrin	381	0.186	5.89 × 10 ⁻⁶	9.70 × 10 ⁻⁶	2.14 × 10 ⁴	3.0	NR

(table continues)

Table 5-31 (continued)

References (except as noted):

Howard et al. 1991

Mackay et al. 1992

Notes:

^a U.S. EPA 1996

^b the most conservative value is listed (the longest half-life indicated in the literature); half-life listed is for microbially mediated degradation in soil (Howard et al. 1991)

^c U.S. National Library of Medicine, Hazardous Substances Data Bank (internet website: <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>)

^d the most conservative aquifer value is listed

^e dash indicates not available

^f chemical not reported in groundwater

Acronyms/Abbreviations

atm-m³/mole – atmosphere cubic meter per mole

°C – degrees Celsius

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

DDT – dichlorodiphenyltrichloroethane

g/mol – grams per mole

K_{oc} – organic carbon partition coefficient

L/kg – liters per kilogram

mg/L – milligrams per liter

mm Hg – millimeters of mercury

OU – operable unit

Table 5-32
Physicochemical Properties of Selected Metals at OU 7 CAOCs

Metals	Atomic Weight (g/mole)	K _d ^a (L/kg) (applicable to soils with pH between 5 and 9)		
		< 10 Percent Clay ^b	10 to 30 Percent Clay	> 30 Percent Clay
Aluminum	26.98	35,300	35,300	35,300
Arsenic	33	5.86	19.4	19.4
Cadmium	112.40	14.9	423	567
Lead	207.2	1.3	4.0	59
Thallium	204.38	45	74	96

Notes:

^a values from Streng and Peterson (1989)

^b percent clay is total weight percent composition of the clay fraction including layered silicates, iron and aluminum oxyhydroxides, and organic matter

Acronyms/Abbreviations:

CAOC – Comprehensive Environmental Response, Compensation, and Liability Act area of concern

g/mole – grams per mole

K_d – distribution coefficient

L/kg – liters per kilogram

OU – operable unit

Section 6

HUMAN-HEALTH RISK ASSESSMENT

The site characterization program for the OU 7 CAOCs at MCLB Barstow was designed to ascertain the presence and concentrations of contaminants and evaluate the nature and extent of contamination. A baseline human-health risk assessment (HHRA) was performed as part of the RI to assess potential impacts from contaminants on human health if no remedial actions were taken. The baseline HHRA documents the hazards and provides information necessary for making risk management decisions on the necessity for remedial alternatives.

This section describes the approach used to estimate risk and provides a qualitative uncertainty evaluation that identifies and characterizes the effects of uncertainties on the risk results. Supplementary information is presented in Appendix H. Detailed information for each CAOC is discussed in Attachments A through G.

Exposure conditions used in the estimation of risk are chosen to represent reasonable maximum exposure (RME). Use of these exposure conditions tends to overestimate risk, which provides risk managers with a margin of safety when making risk management decisions.

The baseline HHRA was conducted in accordance with the Risk Assessment Work Plan (BEI 2003). The Work Plan followed the guidelines published by U.S. EPA in the Risk Assessment Guidance for Superfund: Part A (U.S. EPA 1989) and Part B (U.S. EPA 1991b), and supporting documents and guidelines published by Cal/EPA (1992).

6.1 CHEMICALS OF POTENTIAL CONCERN

This section presents an overview of the data evaluation process used to select the COPCs to be evaluated in the HHRA. The sample data used in the baseline HHRA and the selected COPCs at each CAOC are presented in the individual CAOC-specific attachments.

6.1.1 Data Evaluation Process

During several investigations at the OU 7 CAOCs, soil gas, soil, and groundwater samples were collected and analyzed. The baseline HHRA integrated the data collected as part of the RI with historical data to assess potential impacts to human health from contaminants related to the OU 7 CAOCs if no remedial actions were taken.

Before COPCs were selected for inclusion into the HHRA, all chemical analytical data obtained during the RI field activities were validated to satisfy NFESC Level D requirements. Historical data were not revalidated. However, inconsistencies within historical data sets, and other problems with historic data were resolved when possible. All RI data were evaluated for the data quality indicators (precision, accuracy, representativeness, comparability, and completeness [PARCC]). Data rejected during the validation process were not used in the baseline HHRA. All of the soil gas, soil, and groundwater data used in the HHRA were analyzed at a fixed-base analytical laboratory.

Following the validation process, COPCs were selected based on appropriate U.S. EPA guidance (U.S. EPA 1989). The data evaluation process began by listing all chemicals positively identified in soil gas, soil, and groundwater samples. If the COPCs in the soil

are depth related, each list is limited to chemicals found within the depth of concern. The procedure eliminates the following chemicals that are unlikely to pose a risk to human health:

- naturally occurring inorganic chemicals (metals) whose concentrations are within the range considered normal for the area around the CAOC
- essential nutritional elements of very low toxicity (i.e., calcium, magnesium, potassium, or sodium) present at low concentrations

6.1.2 Soil Data

Data from vadose zone soil were used to select COPCs in the baseline HHRA. The soil interval to be evaluated is scenario related, as the various receptors exposed to the soil may be in contact with distinct soil depths. Therefore, assessment of the soil data would be limited to chemicals reported within the depth of concern. The soil intervals used and the receptors exposed to these soil depths are presented in Section 6.2, Exposure Assessment. Both RI and historical data were used to identify the COPCs in soil.

With exception of CAOC 10.38/10.39 (wastewater collection lines), the soil risk was evaluated for each CAOC on a CAOC-wide basis. CAOC 10.38/10.39 consists of approximately 105,000 feet of pipe with previously identified cracks, broken segments, and offset joints that were possible contaminant release points. To aid in the identification and definition of possible source areas along portions of the pipeline, the HHRA segregated CAOC 10.38/10.39 into seven discrete units to use all the data collected most efficiently. (Refer to Section 4.1, Attachment E, for a more detailed explanation.) The potential on-site risk was estimated for each unit so that remedial actions, if needed, could be developed for relatively localized remediation targets. The units addressed in the risk assessment consist of the following:

- Unit 1 – Aggregate of DS1 and IS1
- Unit 2 – Aggregate of DS3 and IS2
- Unit 3 – DS9
- Unit 4 – Aggregate of DS11 and IS4
- Unit 6 – DS14
- Unit 7 – DS17

Unit 5, consisting of the active domestic wastewater line segment DS12, was not included in the HHRA. DS12 received flow from upflow segment DS13, base housing, and is recommended for no further action. During the RI, samples were collected from one location along DS12. This boring (10.38-DS12-1) was located at a broken pipe section downflow of the only facility (S-181) that may have discharged industrial waste (boiler cleaning solution) along this line segment. The results of the analysis did not indicate a release.

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Concentrations of metals in soil were compared to Barstow background concentrations to identify CAOC-related analytes. The statistical approach was based on a comparison of maximum reported on-site concentrations to the 95th percentile of the background data. The Wilcoxon rank sum and the quantile tests were used to analyze the hypothesis that on-site concentrations are less than or equal to background concentrations. The Background Soils Investigation Technical Memorandum for soils at MCLB Barstow was used to establish the background concentrations for the metals identified at the OU 7 CAOCs (JEG 1994). Background samples collected at Nebo or Yermo regions were selected for the analysis as determined by the geology of each CAOC. Specifics for the statistical on-site-background comparison methodology are detailed in Appendix H. Inorganic nutrients (calcium, magnesium, potassium, and sodium) that are required human trace elements were excluded as COPCs. The concentration range and the chemicals selected as COPCs are presented for each CAOC in the individual CAOC-specific attachments.

Cancer risks and hazard indices (HIs) were calculated for background metals for residential and industrial scenarios at Nebo Main Base and Yermo Annex (Tables 6-1 through 6-4). Those metals with an associated cancer risk greater than 1×10^{-6} or an HI greater than 0.1 are highlighted with shading.

A review of these tables shows that the cancer risk from background metals for the residential scenario at any location on Nebo Main Base is 1.3×10^{-5} (U.S. EPA) to 9.1×10^{-5} (Cal/EPA) and the HI is 1.8; for the industrial scenario, cancer risk is 3.3×10^{-6} (U.S. EPA) to 2.3×10^{-5} (Cal/EPA) and the HI is 0.18. Aluminum, arsenic, chromium, iron, and manganese contribute most of the background risk for the residential scenario; and arsenic and chromium contribute most of the background risk for the industrial scenario. The cancer risk from background metals for the residential scenario at any location on Yermo Annex is 9.4×10^{-6} (U.S. EPA) to 6.7×10^{-5} (Cal/EPA) and the HI is 1.4; for the industrial scenario, cancer risk is 2.7×10^{-6} (U.S. EPA) to 1.8×10^{-5} (Cal/EPA) and the HI is 0.14. As shown by shading in Tables 6-1 through 6-4, aluminum, antimony, arsenic, chromium, iron, and manganese contribute most of the background risk for the residential scenario, and arsenic and chromium contribute most of the background risk for the industrial scenario. As noted previously, risks posed by metals in soil were compared to background concentrations to determine if they were CAOC-related, and those found to be CAOC-related were included in the risk assessment conducted for each CAOC. Therefore, the background metals cancer risks and HIs shown in Tables 6-1 through 6-4, calculated for Nebo Main Base and Yermo Annex, may include risk from metals already included in the CAOC-specific risk assessments. Complete background risk calculations are presented in Appendix H (Parts XVII and XVIII).

The background values shown in the Section 4 tables of each attachment to this report correspond to the 95 percent upper confidence limits (UCLs) for depth intervals 0 to 3, 3 to 13, and greater than 13 feet bgs. Data on the nature and extent of metals in soil were compared to the background data presented in the Background Soils Investigation Technical Memorandum (JEG 1994). However, for risk assessment purposes, the

background values (Appendix H, Part II) were recalculated to provide 95 percent UCLs for depth intervals 0 to 2 and 0 to 13 feet bgs. The use of the 0-to-13-foot soil horizon for developing residential exposure point concentrations (EPCs) at MCLB Barstow was established in the OUs 5 and 6 RI (JEG 1996) and is consistent with subsequent investigations.

6.1.3 Groundwater Data

Selection of COPCs in groundwater was based on data from the first encountered groundwater. Samples collected during the RI and previous investigations were used where appropriate. The data set, composed of analytical results from the latest four monitoring events, is summarized in Appendix H.

Groundwater exposures were assessed for CAOCs where the data collected during the RI indicated a potential release from the soil and subsequent impact to groundwater. The risk associated with groundwater exposures at CAOC N-2 Area 1 was not evaluated because previous investigations and the RI determined that soil COPCs have not reached groundwater. Similarly, groundwater exposures were not assessed at CAOC 10 because the results of the soil data delineated the contaminants both vertically and laterally at the site and indicated that soil COPCs have not reached groundwater. The risk associated with groundwater exposures was evaluated for CAOCs 9.60, 10.27, 10.35, 10.37, and Unit 7 at 10.38/10.39.

In addition, it should be noted that groundwater data were collected from monitoring wells and HydroPunch or equivalent method. Inorganic chemicals were excluded from the HydroPunch data set based on the high turbidity associated with suspended matter that usually occurs in discrete groundwater samples. Metals from the unfiltered monitoring well samples were included in the groundwater data set. Inorganic nutrients (calcium, magnesium, potassium, and sodium) that are known to be required human trace elements were excluded as COPCs. Organic chemicals from both sample types were classified as COPCs.

6.2 EXPOSURE ASSESSMENT

The objective of the exposure assessment was to evaluate the type and magnitude of exposures from COPCs present at a site to a human receptor. An exposure assessment is a multistage process. First, the receptors (i.e., members of the population or individuals at risk) are characterized. Then the complete exposure pathways and routes by which these receptors are likely to be exposed are identified. Finally, the chemical concentrations to which the receptors might be exposed (EPCs) and the chemical intake rates associated with each route of exposure are quantified. The following sections describe the exposure scenarios, exposure pathways, hypothetical receptors, methodology used to quantify exposure for each pathway, and reasons for their selection.

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6.2.1 Receptor Analysis

A receptor analysis is a conceptualized site-specific scenario that identifies the human population at risk and the activities that members of that population would be engaged in to make exposure possible. Exposure settings are typically based on land use.

MCLB Barstow is currently an active military base, and its land use is classified as industrial. MCLB Barstow provides logistical support to DoD and other military organizations by receiving, maintaining, repairing, and storing military supplies and equipment, and trains Marines in the logistical skills of warehousing. As a result of this function, the base presently conducts industrial operations at numerous locations throughout Yermo Annex. Nebo Main Base is primarily used for warehousing and administrative purposes and includes several housing areas where on-base personnel reside. A rifle range is also located in the southern portion of the Nebo Main Base south of Interstate Highway 40. Since the mid-1950s, the rifle range has been used for small arms practice (BNI 1998a). Nebo Main Base (including the rifle range) is an area of approximately 4,006 acres and Yermo Annex is approximately 1,680 acres. For the OU 7 CAOCs, the most likely population at risk under current conditions was identified as base personnel.

Default exposure conditions were applied in estimating current and future risks. Use of default exposure conditions constitutes a conservative overall approach to the assessments and provides an appropriate reference for risk managers to use in making cleanup decisions. Risk was evaluated for OU 7 CAOCs using residential, industrial, and maintenance/repair worker land-use scenarios.

It should be noted that exposure is greater for residential receptors than for any other potential receptor. CAOCs that do not pose a risk under residential exposure conditions will, in turn, not pose a risk under other land-use scenarios (i.e., industrial). Estimations of risk to industrial and maintenance/repair workers provide risk managers with additional information for decision making.

6.2.2 Exposure Pathways

An exposure pathway is the means by which a contaminant moves through the environment from the source to a receptor. Exposure pathways are identified through an analysis of the distribution of the COPCs in the environment and the physical and chemical properties of the COPCs. For a pathway to be complete, all of the following elements must be present: a contaminant source and mechanism for contaminant release, an environmental transport medium, an exposure point, an exposure route, and a receptor. Exposure pathways are illustrated in the individual CAOC attachments.

Children and adult residents at OU 7 could be exposed to COPCs in the soil, soil gas, and groundwater via the following exposure pathways:

- ingestion of impacted soil
- dermal contact with impacted soil

- inhalation of particulates that have been released from impacted soil
- inhalation of chemical vapors released from soil gas that accumulate in buildings (The soil data set was used in the indoor air modeling when soil gas data were not available [CAOC 10.27 and N-2 Area 1]. Groundwater data sets were not used because VOCs were not reported for these CAOCs. The groundwater data set was used in the air modeling for CAOC 10.35 because soil gas data were not available and soil VOCs were not reported.)
- inhalation of chemical vapors released from groundwater during household water use that accumulate in buildings
- ingestion of groundwater
- dermal contact with groundwater

Office/industrial workers and maintenance/repair workers at OU 7 could be exposed to soil, soil gas, and groundwater COPCs via the following exposure pathways:

- ingestion of impacted soil
- dermal contact with impacted soil
- inhalation of particulates that have been released from impacted soil
- inhalation of chemical vapors released from soil gas that accumulate in buildings (industrial worker) or that are released to the atmosphere (maintenance/repair worker) (The groundwater and soil data sets were used in the air modeling whenever soil gas data were not available. The soil data set was used in the outdoor air modeling whenever soil gas data were not available [CAOC 10.27 and N-2 Area 1]. Groundwater data sets were not used because VOCs were not reported for these CAOCs. The groundwater data set was used in the air modeling for CAOC 10.35 because soil gas data were not available and no soil VOCs were reported.)

It should be noted that some CAOCs are paved. Paved areas were conservatively treated as being entirely unpaved, and receptors were assumed to be exposed to COPCs in soil beneath the pavement via soil ingestion, dermal contact with soil, and inhalation of particulates and vapors. This assumption overestimates the risk presented by the soil COPCs at the paved CAOCs. Pavement prevents direct skin contact with and ingestion of the soil and the generation of dust. In addition, it is difficult to estimate the emission rate of volatile chemicals through pavement.

Dermal contact with groundwater for maintenance/repair workers at the OU 7 CAOCs was not considered a viable and complete pathway. The groundwater table at all the CAOCs is at a depth beyond the maximum work depth assumed for this receptor (13 feet bgs).

6.2.3 Exposure Point Concentration

Once complete exposure pathways are selected for evaluation, the final step is to quantify exposure for each pathway. The goal of the quantification step is to identify the combination of exposure variables or parameters that results in the most intense level of

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exposure that may reasonably be expected to occur, known as RME. Exposure quantification is a two-step process: Step 1 entails estimating EPCs and Step 2 entails estimating dose rates.

An EPC is the concentration of a chemical in the contaminated medium (e.g., soil, water, air) at the point of contact with a receptor (e.g., resident). Under RME conditions, U.S. EPA specifies using the 95 percent UCL of the average measured chemical concentrations. In calculating the 95 percent UCLs for the OU 7 CAOCs, the data were tested for normality and lognormality. Sets of data that failed these tests were analyzed using a distribution-free approach (i.e., bootstrap resampling procedure). It should be noted that the maximum concentration was used as the EPC instead of the 95 percent UCLs under either of the following conditions:

- the 95 percent UCL of a chemical exceeds its highest measured concentration
- the sample size is less than three

Data sets contain information for samples with analytes reported as detected and not detected (“nondetects”). Data sets containing nondetects are called “censored” or “left-censored.” Data censoring occurs when empirical information about a quantity is limited to knowing only that its value is less than (or greater than) some threshold. Censored distributions commonly arise when observed chemical concentrations contain results that are reported as nondetects. For estimating means and 95 percent UCLs on the mean, one-half the reporting limit was used for results reported as nondetects. Nondetect results that exceed the maximum detected concentration are not included in statistical calculations used to determine the EPCs, as these data would misrepresent the actual on-site EPC.

Appendix H presents the equations used to calculate the 95 percent UCLs. The EPCs for the COPCs at each CAOC are identified in the individual CAOC-specific attachments.

6.2.3.1 EXPOSURE POINT CONCENTRATIONS FOR COPCs IN SOIL

Exposure to soil COPCs is related to depth; therefore, the assessment is limited to chemicals found within the depth of concern. The data sets used to estimate risks to a hypothetical resident and maintenance/repair worker from exposure to soil COPCs were based on the concentrations measured in shallow soil at the vadose zone at depths from 0 foot to 13 feet bgs. For the industrial worker, surface-soil concentrations (0 foot to 2 feet bgs) were used in the calculation of EPCs.

The soil EPCs developed for the hypothetical residential scenario are based on the 95 percent UCL or the maximum concentration as described above. Appendix H presents the equations used to calculate the 95 percent UCLs. The EPCs and distributions of each soil COPC at each CAOC are also presented in Appendix H.

6.2.3.2 EXPOSURE POINT CONCENTRATIONS FOR VOCs IN SOIL GAS

Soil gas VOCs were identified with data from 5 feet bgs to the deepest sample collected. Estimated soil gas EPCs are either 95 percent UCLs or maximum reported

concentrations. The EPCs and distributions of each VOC at each CAOC are presented in Appendix H.

6.2.3.3 EXPOSURE POINT CONCENTRATIONS FOR COPCs IN GROUNDWATER

Shallow groundwater data from the first encountered groundwater were used to select COPCs in the baseline HHRA. Groundwater was assessed independently for each CAOC.

The groundwater EPCs used from these data sets are either 95 percent UCLs or maximum reported values. The EPCs and distributions of each groundwater COPC at each CAOC are presented in Appendix H.

6.2.3.4 EXPOSURE POINT CONCENTRATIONS FOR COPCs IN AIR

The concentrations of airborne chemicals are calculated on the basis of the EPCs of COPCs in the immediate source area. Two potential sources of airborne chemicals are 1) contaminated soil from which chemical vapors and particles could be released and 2) contaminated groundwater from which chemical vapors could be released.

Particulate Matter

Chemical concentrations in dust were estimated using PM₁₀ data. PM₁₀ refers to airborne particulate matter with an aerodynamic diameter of 10 micrometers or less. Particles of this size are classified as respirable. PM₁₀ data recorded for the Mojave Desert Basin as 24-hour average concentrations in 1988 to 2000 were used in this assessment (Cal/EPA 2004). The mean concentration is 0.038 milligram per cubic meter. Appendix H presents the equation used to estimate chemical concentrations in particulate matter.

Indoor Air – Industrial Setting

The Johnson and Ettinger model was used to evaluate the volatile emissions from soil gas (U.S. EPA 2003). For CAOCs where soil gas data were not available, soil or groundwater data sets were used as the source of volatile chemicals COPCs. The model is based on both convective and diffusive mechanisms of vapor transport for estimating the transport of chemical vapors emanating from either subsurface soils or groundwater into indoor spaces.

The Johnson and Ettinger model assumes all vapors from the underlying impacted soil and groundwater have migrated vertically upward and are entering the building through gaps and openings at the seams between the subgrade walls and concrete slabs (or foundation). The model refers to these gaps as “floor-wall seam crack” (U.S. EPA 2003). Inputs to the model include chemical properties of the COPC, soil properties, and structural properties of the building. Appendix H presents the parameters used in the Johnson and Ettinger simulations and the resultant concentrations in the indoor vapor phase.

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Indoor Air – Residential Setting

For the residential scenario, the Johnson and Ettinger model (U.S. EPA 2003) was used to estimate the volatile emissions from soil gas. For CAOCs where soil gas data were not available, the soil data set was used as the source of volatile chemicals COPCs. The default assumptions for a single-family house implemented within the model were utilized in the simulations. Appendix H presents the parameters used in the simulation of volatile emissions and summarizes resultant concentrations in the residential indoor vapor phase.

In addition, since groundwater is used for domestic purposes under a residential setting, the vapor-phase concentration of volatile groundwater chemicals was estimated by use of an upper-bound volatilization constant (VF_w) (U.S. EPA 1991a) based on all uses of household water (e.g., showering, laundering, and dish washing). The VF_w assumes that the average transfer efficiency is 50 percent (i.e., half of the concentration of each chemical in water will be transferred into air by all water uses).

The equation used to calculate doses for inhaled groundwater vapors under a residential setting contains the VF_w ; therefore, concentration values for airborne groundwater vapors under a residential scenario are not presented in Appendix H. The VF_w algorithm is summarized in Appendix H.

Outdoor Air – Maintenance/Repair Setting

For the maintenance/repair worker scenario, air concentrations in outdoor areas were estimated using the American Society for Testing and Materials emission model (ASTM 2002) for VOCs in soil gas (soil or groundwater data were used for CAOCs with no soil gas data). This model is based on diffusive mechanisms of vapor transport for estimating the transport of chemical vapors emanating from either subsurface soils or groundwater into outdoor areas. The emission factor produced by the model is called a volatilization factor. EPCs in air were estimated by integrating the volatilization factor estimated for each COPC with the concentration in soil gas (soil or groundwater). Appendix H presents the methodology and parameters used by the model and the resultant concentrations in the outdoor vapor phase.

6.2.4 Estimation of Dose Rate

Dose rate is the amount of chemical to which a receptor is exposed per unit body weight and time. Dose rates were estimated by integrating intake variables such as ingestion rate, body weight, and exposure duration with the contaminant concentration. The combination of all intake variables results in an estimate of exposure for each pathway. Dose may be expressed as rate of application (applied dose) or as a rate of absorption (absorbed dose). Equations in U.S. EPA guidance documents (U.S. EPA 1989, 1991b) calculate applied dose when exposure occurs by ingestion and inhalation, and absorbed dose when exposure occurs by dermal contact.

The specific equations for each exposure pathway and the values assigned to the equation parameters are provided in Appendix H. The general equation for calculating dose is as follows:

$$D = (C \times CR \times EF \times ED) / (BW \times AT)$$

where

- D* = daily dose averaged over the exposure period (milligrams per kilogram [mg/kg] per day)
- C* = chemical concentration in the exposure medium (mg/kg)
- CR* = contact rate with the exposure medium (kilograms per day)
- EF* = exposure frequency (days per year)
- ED* = exposure duration (years)
- BW* = body weight of the exposed individual (kilograms)
- AT* = averaging time (days)

6.2.5 Exposure Assumptions

Exposure assumptions describe the rate of contact that the receptors could have with the soil, water, or air. U.S. EPA guidelines on upperbound exposure assumptions are designed to address the behavior or activity patterns more conservatively than 90 to 95 percent of the receptor populations. The intent is to estimate an RME.

The exposure assumptions for a hypothetical resident adult and child exposed to soil gas, soil, and groundwater at OU 7 are the following standard U.S. EPA default assumptions.

- For soil oral exposure, 100 milligrams a day was assumed for a 70-kilogram adult and 200 milligrams a day for a 15-kilogram child (age 1 to 6 years), 350 days a year.
- For soil dermal exposure, more than 30 percent of the resident's skin is in contact with soil for 350 days a year. The skin surface area considered for adult receptors is 5,700 square centimeters and for child receptors is 2,900 square centimeters.
- Inhalation of dust and vapors was assumed to occur 24 hours a day, 350 days a year.
- Exposure to vapors was assumed to occur exclusively indoors. The inhalation rates of 0.42 and 0.83 cubic meter per hour were assumed for children and adults, respectively.
- For groundwater consumption, 2 liters of water a day was assumed for a 70-kilogram adult and 1 liter a day for a 15-kilogram child (age 1 to 6 years), 350 days a year.
- For groundwater dermal exposure during showering, whole-body exposure (7,000 square centimeters for children and 19,000 square centimeters for adults) was assumed to occur for 0.25 hour a day, 350 days a year.
- Inhalation of groundwater volatiles during household water use was assumed to occur for 24 hours a day, 350 days a year.

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- Adult exposure was assumed for a total of 30 years, 6 years as a child and 24 years as an adult (child exposure was assumed to be 6 years).

The exposure assumptions for the industrial worker are as follows.

- Work is performed for 8 hours a day, 250 days a year.
- Work is performed for a period of 25 years.
- For soil dermal exposure, over 30 percent of a worker's skin is in contact with soil. The skin surface area considered for the industrial worker is 5,700 square centimeters.
- Inhalation of dust and vapors was assumed to occur 8 hours a day, 250 days a year.
- Exposure to vapors was assumed to occur exclusively indoors.
- For soil oral exposure, 100 milligrams a day was assumed for the industrial worker.

The exposure assumptions for the maintenance/repair worker are as follows.

- Work is performed for 8 hours a day, 250 days a year.
- Work is performed for a period of 1 year.
- For soil dermal exposure, over 30 percent of a worker's skin is in contact with soil. The skin surface area considered for the maintenance/repair worker is 5,700 square centimeters.
- Inhalation of dust and vapors was assumed to occur 8 hours a day, 250 days a year.
- Exposure to vapors was assumed to occur exclusively outdoors.
- For soil oral exposure, 480 milligrams a day was assumed for the maintenance/repair worker.

6.3 TOXICITY ASSESSMENT

This section presents the toxicity assessment for the COPCs identified at the OU 7 CAOCs at MCLB Barstow. The objective of the toxicity assessment is to determine the relationship between dose and toxic response for each COPC. From this relationship, an estimate of toxic potency is developed for use in characterizing risk. The toxicity assessment identifies toxicity criteria (values) for each of the chemicals chosen for inclusion in the risk assessment and the types of effects each of the chemicals is able to produce. Toxicological chemical effects fall into two categories: those that could potentially cause cancer (carcinogens) and those that cause other types of health effects (e.g., liver damage [noncarcinogens]).

Each of the toxicological chemical effects is described by assigning a toxicity factor. Toxicity factors are numbers that indicate the toxicity of the chemicals. The toxicity factor for carcinogenic effects is called a cancer slope factor (CSF), and the toxicity

factor for noncarcinogenic effects is called a reference dose (RfD). Chemicals that show a potential for both carcinogenic and noncarcinogenic health effects are assigned both slope factors and reference doses. Toxicity factors for COPCs are listed in Appendix H. The toxicity factors are combined with the chronic daily dose to calculate a numerical estimate of risk.

6.3.1 Source of Toxicity Criteria

The toxicity values used in this risk assessment were obtained from the 2002 and 2004 tables of PRGs published by U.S. EPA Region 9 (U.S. EPA 2002, 2004a) and were confirmed by a review of the U.S. EPA Integrated Risk Information System (IRIS) database (U.S. EPA 2004b) and the U.S. EPA Health Effects Assessment Summary Tables (HEAST) (U.S. EPA 1997). The IRIS database and HEAST were also searched for toxicity criteria for chemicals not listed in the table of PRGs.

Updated toxicity factors are based on the October 2004 PRG table. Original toxicity factors represent CSF and RfD values available at the time the HHRAs were performed (December 2003 to July 2004). Subsequently, updated CSF and RfD values were published in the October 2004 PRG table. Updated toxicity factors from the October 2004 PRG table that created an increase in cancer risk or noncancer hazard were incorporated (July 2005) into this version of the RI Report in an effort to avoid underestimating on-site cancer risks and noncancer hazards. Updated toxicity factors creating a decrease in cancer risk or noncancer hazard were not incorporated as they would not have resulted in a significant decrease in risk at a CAOC.

6.3.2 California Environmental Protection Agency Toxicity Criteria

CSFs developed by the Cal/EPA were also implemented in the risk assessment. The Cal/EPA CSFs are listed in the Office of Environmental Health and Hazard Assessment toxicity database (Cal/EPA 2003, 2005). Use of Cal/EPA toxicity values in addition to the U.S. EPA CSFs permits dual tracking of the cancer risk. Dual tracking consists of a risk assessment evaluation solely using U.S. EPA toxicity values and a separate risk assessment evaluation using California toxicity values.

Updated toxicity factor are based on Office of Environmental Health Hazard Assessment (OEHHA) values available in July 2005. Original toxicity factors represent CSF values available at the time the HHRAs were performed (December 2003 to July 2004). Subsequently, updated CSF values were published in the September 2004 OEHHA Cancer Potency List and later in the OEHHA toxicity criteria database. Updated toxicity factors creating an increase in cancer risk hazard were later incorporated (July 2005) in an effort to avoid underestimating on-site cancer risks. Updated toxicity factors creating a decrease in cancer risk or noncancer hazard were not incorporated as they would not have resulted in a significant decrease in risk at a CAOC.

Subsequent to compiling toxicity factors for the Barstow HHRAs, the oral CSF for TCE was updated in the OEHHA toxicity criteria database. The original oral CSF of 0.0153 inverse of milligrams per kilogram per day ($[\text{mg/kg-day}]^{-1}$) was revised to 0.013 (mg/kg-

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day)⁻¹. According to OEHHA, this revision was made to correct a data input error. The incorrect oral CSF was applied in Cal/EPA oral cancer risk calculations and also used as an estimated dermal CSF, which was applied in Cal/EPA dermal cancer risk calculations. Therefore, the oral and dermal Cal/EPA cancer risk values presented in the HHRAs are elevated. More accurate estimates, based on the correct CSFs, are approximately 15 percent less than the cancer risk values presented in the HHRAs.

6.3.3 Toxicity Criteria for Dermal Exposure

CSFs and RfDs were developed by agencies specifically to estimate risk associated with ingestion and inhalation of chemical substances and are, with few exceptions, based on administered doses. CSFs or RfDs have not been developed specifically for dermal exposure. The standard U.S. EPA dermal dose equation produces an absorbed dose. Theoretically, equivalent doses must be used to achieve a meaningful comparison between the dermal dose estimates and the toxicity criteria. Risk Assessment Guidance for Superfund (U.S. EPA 1989) recommends adjusting the oral RfDs and CSFs for gastrointestinal absorption so that they represent absorbed doses and using the adjusted toxicity value to estimate dermal risk. Using the oral toxicity criteria without adjustment should theoretically underestimate dermal risk. However, when used with adjustment, an oral toxicity criterion causes the dermal risk to exceed the oral risk by a considerable margin for some substances. Therefore, in the risk assessment, oral toxicity criteria were used to estimate dermal risk without adjustment.

6.3.4 Toxicity Criteria for COPCs Without Assigned Criteria

When no oral or inhalation RfD was available for a chemical, it was assigned the oral and inhalation RfD of another chemical of similar structure or chemical class (i.e., surrogates). Similarly, when a CSF was not available for a carcinogenic chemical, it was assigned the CSF of a structural analog. Appendix H identifies the chemicals without toxicity criteria and their chemical surrogates.

6.4 RISK CHARACTERIZATION

The final step in any risk assessment is the characterization of risk in which the exposure and toxicity information generated in previous sections are integrated to evaluate the potential health risks. Cancer risk and noncancer risk are quantified separately. The following text presents the methods used in the estimation of risk and provides a summary of the resultant risks for all OU 7 CAOCs. The calculations for each pathway are presented in the site attachments. Because of differences between U.S. EPA and Cal/EPA CSFs, risk was estimated by using both U.S. EPA CSFs and Cal/EPA CSFs.

6.4.1 Cancer Risk

The equation specified in the U.S. EPA Risk Assessment Guidance for Superfund (U.S. EPA 1989) for estimating cancer risk is:

$$\text{cancer risk} = \text{CSF} \times \text{estimated dose rate}$$

Cancer risk is an upperbound estimate of individual excess probability of increased cancer incidence resulting from exposure to a potential carcinogen. The cancer risks presented by different carcinogens are added across all of the exposure pathways and intake routes to obtain an estimate of overall risk.

A cancer risk probability of 1×10^{-6} means that the estimated increase in an individual normal or baseline cancer risk is no greater than 1 in 1,000,000 for a lifetime of exposure, and it may be considerably less. A summary of the results at all OU 7 CAOCs, the risk associated with each exposure pathway, and the COPCs identified as risk drivers are presented in each CAOC-specific attachment.

6.4.2 Noncancer Health Effects

The equation specified for estimating noncancer risk (U.S. EPA 1989) is:

$$\text{noncancer risk} = \text{estimated dose rate/RfD}$$

This ratio of dose to nontoxic dose is called a hazard quotient. The hazard quotient is a measure of whether or not the estimated dose of a chemical exceeds the highest nontoxic dose (i.e., the RfD—a daily exposure level that is likely to be without an appreciable risk of deleterious effects during a lifetime). Therefore, toxic effects are considered likely to occur when the hazard quotient exceeds 1.0. Although not a linear relationship, the likelihood and severity of effects increase as the ratio increases above 1.0. A conservative estimate of the hazard associated with exposure to all chemicals by a specific pathway, such as the inhalation pathway, is obtained by summing the hazard quotients of the chemicals associated with the pathway. The sum of hazard quotients is called a hazard index.

Hazard indices are not probabilities. A hazard index is a ratio of an exposure level to a nontoxic level. Because a hazard index value of 1.0 indicates that lifetime exposure has limited potential for causing an adverse effect in sensitive populations, values of less than 1.0 can generally be considered acceptable. Values greater than 1.0 are usually given closer attention. Attachments A through G present the hazard indices for the OU 7 CAOCs, the hazard index associated with each exposure pathway, and the COPCs identified as risk drivers. Appendix H presents the contribution of each chemical to the total hazard index.

The evaluation of lead is based on noncarcinogenic effects. The assessment of the risk presented by lead consisted of first comparing the concentration of lead in shallow soils at the CAOCs to the residential Cal/EPA PRG of 150 mg/kg. For the industrial land use (industrial and maintenance/repair workers), the comparison is based on the industrial Cal/EPA PRG of 750 mg/kg. In the event that these PRGs are exceeded, the Cal/EPA pharmacokinetic model (LeadSpread 7) is used, and the concentration of lead in the blood is compared to the acceptable concentration of 10 micrograms per deciliter. The risk for lead is presented in each CAOC attachment.

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6.5 UNCERTAINTY ANALYSES

Each component of the baseline HHRA (selection of COPCs, exposure assessment, toxicity assessment, and risk characterization) involves uncertainties that result from intrinsic measurement errors and from the use of models in lieu of actual data. Uncertainties may cause risk to be overestimated or underestimated to varying degrees, and the risk estimates should not be taken as absolute indicators of whether adverse health effects could occur.

A qualitative approach identified the variables and assumptions that contribute to uncertainty. Regulatory decisions depend not only on the calculated risk estimates but also on the uncertainties and assumptions incorporated into the risk estimates. Accordingly, a discussion of some of the more important uncertainties is provided.

6.5.1 Data Evaluation

Factors that may introduce uncertainty into site environmental data include:

- sample collection methods,
- characterization of surface and subsurface geology and hydrology,
- representativeness and completeness of data,
- adequacy of data to describe site conditions, and
- analytical methods, detection limits, and QA/QC procedures.

The procedures used to analyze chemicals in environmental media may have introduced errors. A series of laboratory blank samples and other samples are designed to detect errors introduced in this manner. Field quality control samples are taken in association with environmental samples to assure that chemicals detected are representative of the site. Equipment rinsates, field blanks, and trip blanks are used to monitor field sampling procedures to assure that chemicals are not introduced into the samples and to identify potential for high bias in the regular samples. All data used in this assessment were evaluated and found to be of acceptable quality.

Selecting representative sampling locations and collecting a sufficient number of samples determine the success of characterizing a contaminated site. Uncertainty associated with the sampling process may result in either the overestimation or underestimation of risk. Uncertainties are associated with the collection, analysis, and evaluation of environmental data regarding the COPCs selected for use in the risk assessment. Sampling programs are necessarily limited in space and time. Environmental sampling may or may not have accurately characterized concentrations of chemicals.

Samples collected during previous investigations were included in this risk assessment. Different investigations used different analytical methods, so the detection limits used for reporting analytical results were also slightly different. Consequently, some degree of uncertainty resulting in an underestimate or overestimate of risk is possible.

Data evaluation involves using statistics to summarize the data. The maximum detected value was used instead of the 95 percent UCL when the UCL of a chemical exceeded its highest measured concentration. Use of the maximum concentration does not reflect a reasonable estimate of exposure. It is unlikely that a receptor would be exclusively exposed to a single sampling result over the long-term exposure period evaluated in this assessment.

Results reported as not detected were used to calculate EPCs by applying a surrogate value of one-half the reporting limit. The reporting limit may also be referred to as the sample quantitation limit. One-half the reporting limit, rather than one-half the method detection limit (which is a lesser value) was chosen as the surrogate value as a conservative approach. Because the reporting limit is a greater value than the method detection limit, this approach is likely to result in overestimates of exposures and risks.

6.5.2 Exposure Assessment

The principal uncertainties associated with the exposure assessment are categorized by scenario assumptions and quantification of exposure. These sources of uncertainty are discussed in the following subsections.

6.5.2.1 SCENARIO ASSUMPTIONS

The prediction of human activities that lead to contact with environmental media and exposure to chemicals constitutes a principal area of uncertainty in exposure assessment. Activities that differ from those used in the exposure assumptions could lead to higher or lower risks than those estimated. In addition, the assumption that all exposures occur concurrently introduces an uncertainty into the resulting risk estimates. To compensate for this uncertainty, conservative estimates of exposure were used.

If some of the activities do not occur or if they occur for shorter periods of time than the estimates used in this assessment, the risks presented here would be higher than “true” risks. For this assessment it was assumed that individuals (i.e., resident, industrial, and maintenance/repair workers) would engage regularly in activities that would result in exposures to COPCs; however, such events could occur only occasionally and the receptor would not necessarily experience an exposure. For instance, an exposure of 24 hours per day for 30 years was used for the residential receptor. This value represents a conservative estimate because it is highly unlikely that an individual would experience this continuous exposure. A similar assumption was implemented for the industrial worker in which this receptor was assumed to work on-site 250 days a year for a period of 25 years. This is highly unlikely, especially considering how employees are frequently transferred from location to location. Similar conservative hypotheses were applied to the maintenance/repair worker receptor. Use of these assumptions to estimate risk was generally designed to be conservative and, therefore, contributes to an overestimation of risk.

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6.5.2.2 QUANTIFICATION OF EXPOSURE

The chemical concentrations were assumed to remain constant for the entire exposure duration. It is highly unlikely that the organic chemical concentrations will remain constant, particularly in soil.

Uncertainties could result from the use of models in lieu of actual data. The assumptions and input variables used to estimate exposure concentrations may or may not represent actual conditions at the sites. The following discussion illustrates the significant assumptions and inherent uncertainties associated with the use of modeled data.

Uncertainties in Air Modeling

Airborne Particulate Model. The airborne particulate model (Appendix H) was used to determine the mass transport of contaminants into the air phase. The airborne particulate model calculates the mass transport of particulates of soil to air by the use of PM₁₀ measured for the Mojave Desert Basin. The highest annual geometric mean of PM₁₀ likely resulted from a variety of sources including motor vehicles; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush burning; industrial sources; and windblown dust from open lands. Furthermore, particulate matter can be formed in the atmosphere when gaseous pollutants such as sulfur dioxide and nitrogen dioxide undergo a chemical reaction that contributes to PM₁₀. However, this risk assessment assumed that all particulate matter originated from on-site windblown soil. This assumption is therefore highly unlikely and conservative, considering all the other potential sources that contribute to PM₁₀. In addition, the assessment assumed that the indoor particulate fraction equaled the outdoor amount.

Indoor Vapor Intrusion Model. Vapor intrusion into building structures from soil gas, subsurface soil, or groundwater was modeled using the Johnson and Ettinger model (U.S. EPA 2003). The model assumes all vapors from the underlying impacted soil have migrated vertically upward and are entering the building through gaps and openings at the seam between the subgrade walls and concrete slab (or foundation). Although the model's major assumptions, combined with default values for selected parameters, create uncertainty, this uncertainty typically produces conservative indoor concentration predictions. The following model assumptions have created uncertainty resulting in conservative estimates of indoor vapor concentrations.

- Instantaneous mixing: The model treats the building as a single chamber with instantaneous and homogeneous vapor dispersion, neglecting room-to-room variation in vapor concentration due to mechanical and/or natural ventilation.
- No degradation: The model does not account for the natural degradation or natural attenuation of compounds in aerobic environments (such as the vadose zone).

The soil gas model operates under the assumption of steady-state conditions. This means that enough time has passed for the vapor plume to have reached the building of interest directly above the source of contamination and that the vapor concentrations have reached their maximum values. Depending on the depth at which the soil gas is sampled,

diffusion of the soil gas toward the building is a function of the soil properties between the building floor in contact with the soil and the sampling depth. At the CAOCs evaluated, soil gas samples were collected at various depths. This variability conveys intrinsic uncertainties into the air modeling results.

Other processes occurring in the subsurface can also contribute uncertainty to the indoor air EPCs estimation via other mechanisms (U.S. EPA 2003). Transformation processes such as biodegradation may be important, and in some cases only a relatively thin stratum of bioactive soil can greatly reduce the emission flux toward the soil surface. In addition, subsurface phase equilibrium is a dynamic process resulting in varying vapor-phase concentrations over time at the same sampling location and depth. These factors can result in significant differences in measured soil gas concentrations over relatively small spatial and temporal scales.

Residential Groundwater Indoor Vapor Emissions. The residential indoor vapor-phase concentration of volatile groundwater chemicals was estimated by use of a VF_w (U.S. EPA 1991a) based on all uses of household water (e.g., showering, laundering, and dish washing). The VF_w assumes that the average transfer efficiency is 50 percent (i.e., half of the concentration of each chemical in water will be transferred into air by all water uses).

It should be noted that vapor-phase concentrations estimated by use of the 50 percent VF_w assumes a constant dissolved-chemical source concentration resulting in an overprediction of vapor concentrations. Hence, the vapor-phase concentrations estimated are considered an upper-bound estimate.

Outdoor Vapor Emission Model. Volatilization of soil and groundwater contaminants in outdoor areas was simulated by use of the American Society for Testing and Materials emission model (ASTM 2002). This model is based on diffusive mechanisms of vapor transport for estimating the transport of chemical vapors. The major modeling assumptions that contribute to uncertainty include the following.

- The equations assume a constant dissolved-chemical source concentration in both soil and groundwater, which results in an overprediction of outdoor vapor concentrations.
- The model does not account for chemical loss as the chemical diffuses toward the ground surface (no natural attenuation), resulting in an overprediction of outdoor vapor concentrations.
- The ASTM emission model uses a steady, well-mixed atmospheric dispersion of the emanating vapors within the breathing zone as modeled by a “box model” for air dispersion. The equations do not spatially bias predicted vapor concentrations within site boundaries according to known areas of subsurface soil contamination, resulting in an overprediction or underprediction of indoor vapor concentrations. Additionally, the equations require wind speed values that can create uncertainty if default values vary significantly from site-specific values.

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6.5.3 Toxicity Assessment

Toxicity values (CSFs and RfDs) were not available for all the chemical COPCs. Some chemicals lacking toxicity criteria were assessed quantitatively with surrogate criteria. Uncertainty related to lack of an RfD or CSF might result in an underestimation or overestimation of risk.

An understanding of the degree of uncertainty associated with toxicity values is an important part of interpreting the resultant risk estimates. The degree of uncertainty associated with each toxicity value is expressed by degree of confidence in RfDs and by weight-of-evidence classification of slope factors. The uncertainty associated with the RfD for the noncancer risk drivers indicates that its toxicity value might change if additional data become available. Hence, the resultant risk estimates should not be taken as absolute indicators of risk.

It should also be noted that U.S. EPA toxicity values for several of the COPCs (i.e., TCE and PCE) are “provisional” values and subject to change. These provisional values have not been verified by the U.S. EPA RfD/CSF workgroup. It is unknown whether all studies examining the toxicity of chemicals with provisional values were considered for the development of these factors. Consequently, uncertainty related to the assessment of COPCs with provisional toxicity values is high.

For carcinogens, the weight-of-evidence classification is based on the completeness of the experimental evidence that the agent causes cancer in animals and humans. A small number of the cancer-causing COPCs were classified as known human carcinogens (A), with the majority classified as probable human carcinogens (B1 or B2).

In addition, the degree of uncertainty in evaluating potential residential health risks associated with the inhalation exposure route should be noted. The inhalation RfDs used, published in the Region 9 Table of PRGs, are representative of exposures to an adult receptor. This adult RfD is also used to estimate the noncancer risk for a resident child. Use of an adult RfD overestimates the resultant hazard to a child.

The overall quality of the toxicology database contains numerous uncertainties, including lack of consistency between different experimental studies, small numbers of studies, lack of available information on multiple species and multiple routes of administration, lack of a demonstration of a clear dose-response relationship, lack of plausible biological mechanisms of action, and lack of direct evidence of effects in humans.

For ingestion exposures, the availability of chemicals in the body is assumed to be the same as that in the studies from which toxicity factors were developed. Most toxicity parameter values are calculated for use with administered doses rather than absorbed doses, but the values still reflect the bioavailability in the as-administered form. The risks are likely to be overestimated if bioavailability from media is less than from the form of administered doses in toxicological studies. Dermal toxicity factors were based on these same orally administered doses. Exhibit 4-1 of U.S. EPA’s risk assessment guidance for Superfund (Part E) (U.S. EPA 2001) presents gastrointestinal absorption (ABS_{GI}) values that may be applied to adjust dermal toxicity values. Six COPCs

(antimony, barium, beryllium, cadmium, manganese, and silver) identified at MCLB Barstow have ABS_{GI} values that indicate poor gastrointestinal absorption (less than 50 percent of administered dose [ABS_{GI} less than 50 percent]). Of these six COPCs, none are identified as risk drivers in the cancer risk assessments, and only one (manganese) is identified as a noncancer risk driver with a hazard quotient of 0.69 at CAOC 10.27. No adjustment was made to account for ABS_{GI} values; therefore, the dermal risk values may be underestimated. The degree of underestimation is inversely proportional to each COPC's ABS_{GI} value.

Toxicity of each chemical was assumed to be additive. Interactions between chemicals, synergisms or antagonisms, were not accounted for due to the limited toxicity information on these types of interactions. Interactions could result in over- or underestimations of risk.

6.5.4 Risk Characterization

Risks are assumed to be additive for multiple contaminants and pathways to the same receptor and for the same exposure period. Although unavoidable, the additivity of risks and hazard indices may not be appropriate because of synergistic or antagonistic interactions among the COPCs, resulting in an overestimate or underestimate of risk and an overestimate or understatement of the need for action.

Table 6-1
Background Metals Cancer Risks and Hazard Indices
Residential Scenario (0 to 13 feet bgs), Nebo Main Base

CAS Number	Background Metal	EPC ^a (mg/kg)	U.S. EPA Residential PRGs and Risk Estimates ^{b,c}				Cal/EPA Cancer Risk Estimates ^{b,c}
			Cancer PRG (mg/kg)	Cancer Risk	Noncancer PRG (mg/kg)	Noncancer HI	
7429-90-5	ALUMINUM	8,240			76,000	0.22	
7440-38-2	ARSENIC	3.61	0.062	1.E-05	22	0.17	6.E-05
7440-39-3	BARIUM	80.7			5,400	0.026	
7440-41-7	BERYLLIUM	0.438		2.E-08	150	0.0043	2.E-08
7440-42-8	BORON	17.4			16,000	0.0015	
7440-43-9	CADMIUM	0.63		2.E-08	37	0.0081	4.E-08
7440-47-3	CHROMIUM	14.5		3.E-06	100,000	0.073	3.E-05
7440-48-4	COBALT	8.97	900	4.E-07	1,400	0.036	
7440-50-8	COPPER	18.8			3,100	0.0062	
7439-89-6	IRON	16,500			23,000	0.72	
7439-92-1	LEAD	6.4			150	NE	
7439-96-5	MANGANESE	283			1,800	0.40	
7439-98-7	MOLYBDENUM	0.766			390	0.0020	
7440-02-0	NICKEL	12.8		5.E-08	1,600	0.0084	5.E-08
7782-49-2	SELENIUM	0.14			390	0.00037	
7440-22-4	SILVER	0.27			390	0.00071	
7440-24-6	STRONTIUM	62.8			47,000	0.0014	
7440-28-0	THALLIUM	0.125			5	0.021	
7440-62-2	VANADIUM	38.4			78	0.072	
7440-66-6	ZINC	30.7			23,000	0.0013	
Total	NA	NA	NA	1.E-05	NA	1.8	9.E-05

Notes:

- ^a EPC is the 95 percent UCL of the mean for normal, lognormal, and nonparametric distributions, or the maximum result
- ^b metals with an associated cancer risk greater than 1×10^{-6} or an HI greater than 0.1 are shaded
- ^c complete risk calculations presented in Appendix H (Part XVII)

Acronyms/Abbreviations:

bgs – below ground surface
CAS – Chemical Abstracts Service
EPC – exposure point concentration
HI – hazard index
mg/kg – milligrams per kilogram
NA – not applicable
NE – not evaluated; risk from lead is evaluated using LeadSpread 7 model
PRG – preliminary remediation goal
UCL – upper confidence limit

Table 6-2
Background Metals Cancer Risks and Hazard Indices
Industrial Scenario (0 to 2 feet bgs), Nebo Main Base

CAS Number	Background Metal	EPC ^a (mg/kg)	U.S. EPA Residential PRGs and Risk Estimates ^{b,c}				Cal/EPA Cancer Risk Estimates ^{b,c}
			Cancer PRG (mg/kg)	Cancer Risk	Noncancer PRG (mg/kg)	Noncancer HI	
7429-90-5	ALUMINUM	10,800			100,000	0.027	
7440-38-2	ARSENIC	3.83	0.12	3.E-06	260	0.017	2.E-05
7440-39-3	BARIUM	92.5			67,000	0.0027	
7440-41-7	BERYLLIUM	0.629	1,900	4.E-09	1,900	0.00055	4.E-09
7440-42-8	BORON	25.6			100,000	0.00028	
7440-43-9	CADMIUM	0.676		3.E-09	450	0.00067	7.E-09
7440-47-3	CHROMIUM	18.1	450	5.E-07	NA	0.0078	6.E-06
7440-48-4	COBALT	10.6	1,900	7.E-08	13,000	0.0042	
7440-50-8	COPPER	18.7			41,000	0.00051	
7439-89-6	IRON	19,200			100,000	0.070	
7439-92-1	LEAD	8.02			800	NE	
7439-96-5	MANGANESE	304			19,000	0.043	
7439-98-7	MOLYBDENUM	0.868			5,100	0.00019	
7440-02-0	NICKEL	14.8		9.E-09	20,000	0.00081	9.E-09
7782-49-2	SELENIUM	0.146			5,100	0.000032	
7440-22-4	SILVER	0.304			5,100	0.000066	
7440-24-6	STRONTIUM	57.9			100,000	0.00011	
7440-28-0	THALLIUM	0.141			67	0.0019	
7440-62-2	VANADIUM	42.6			1,000	0.0066	
7440-66-6	ZINC	39.3			100,000	0.00014	
Total	NA	NA	NA	3.E-06	NA	0.18	2.E-05

Notes:

- ^a EPC is the 95 percent UCL of the mean for normal, lognormal, and nonparametric distributions, or the maximum result
- ^b metals with an associated cancer risk greater than 1×10^{-6} or an HI greater than 0.1 are shaded
- ^c complete risk calculations presented in Appendix H (Part XVII)

Acronyms/Abbreviations:

bgs – below ground surface
CAS – Chemical Abstracts Service
EPC – exposure point concentration
HI – hazard index
mg/kg – milligrams per kilogram
NA – not applicable
NE – not evaluated; risk from lead is evaluated using LeadSpread 7 model
PRG – preliminary remediation goal
UCL – upper confidence limit

Table 6-3
Background Metals Cancer Risks and Hazard Indices
Residential Scenario (0 to 13 feet bgs), Yermo Annex

CAS Number	Background Metal	EPC ^a (mg/kg)	U.S. EPA Residential PRGs and Risk Estimates ^{b,c}				Cal/EPA Cancer Risk Estimates ^{b,c}
			Cancer PRG (mg/kg)	Cancer Risk	Noncancer PRG (mg/kg)	Noncancer HI	
7429-90-5	ALUMINUM	8,050			76,000	0.22	
7440-36-0	ANTIMONY	3.34			31	0.11	
7440-38-2	ARSENIC	2.8	0.062	7.E-06	22	0.13	5.E-05
7440-39-3	BARIUM	85.9			5,400	0.028	
7440-41-7	BERYLLIUM	0.276		1.E-08	150	0.0027	1.E-08
7440-42-8	BORON	10.2			16,000	0.00087	
7440-43-9	CADMIUM	0.871		2.E-08	37	0.011	6.E-08
7440-47-3	CHROMIUM	9.74		2.E-06	100,000	0.049	2.E-05
7440-48-4	COBALT	4.3	900	2.E-07	1,400	0.017	
7440-50-8	COPPER	8.91			3,100	0.0029	
7439-89-6	IRON	11,200			23,000	0.49	
7439-92-1	LEAD	7.54			150	NE	
7439-96-5	MANGANESE	207			1,800	0.30	
7439-98-7	MOLYBDENUM	0.616			390	0.0016	
7440-02-0	NICKEL	7.82		3.E-08	1,600	0.0051	3.E-08
7782-49-2	SELENIUM	0.119			390	0.00031	
7440-24-6	STRONTIUM	59.7			47,000	0.0013	
7440-62-2	VANADIUM	27.4			78	0.051	
7440-66-6	ZINC	27			23,000	0.0012	
Total	NA	NA	NA	9.E-06	NA	1.4	7.E-05

Notes:

- ^a EPC is the 95 percent UCL of the mean for normal, lognormal, and nonparametric
- ^b metals with an associated cancer risk greater than 1×10^{-6} or an HI greater than 0.1 are shaded
- ^c complete risk calculations presented in Appendix H (Part XVIII)

Acronyms/Abbreviations:

- bgs – below ground surface
- CAS – Chemical Abstracts Service
- EPC – exposure point concentration
- HI – hazard index
- mg/kg – milligrams per kilogram
- NA – not applicable
- NE – not evaluated; risk from lead is evaluated using LeadSpread 7 model
- PRG – preliminary remediation goal
- UCL – upper confidence limit

Table 6-4
Background Metals Cancer Risks and Hazard Indices
Industrial Scenario (0 to 2 feet bgs), Yermo Annex

CAS Number	Background Metal	EPC ^a (mg/kg)	U.S. EPA Residential PRGs and Risk Estimates ^{b,c}				Cal/EPA Cancer Risk Estimates ^{b,c}
			Cancer PRG (mg/kg)	Cancer Risk	Noncancer PRG (mg/kg)	Noncancer HI	
7429-90-5	ALUMINUM	8,440			100,000	0.021	
7440-36-0	ANTIMONY	3.81			410	0.010	
7440-38-2	ARSENIC	3.19	0.12	2.E-06	260	0.014	1.E-05
7440-39-3	BARIUM	103			67,000	0.0030	
7440-41-7	BERYLLIUM	0.328	1,900	2.E-09	1,900	0.00029	2.E-09
7440-42-8	BORON	5.97			100,000	0.000065	
7440-43-9	CADMIUM	1.12		5.E-09	450	0.0011	1.E-08
7440-47-3	CHROMIUM	11.9	450	3.E-07	NA	0.0051	4.E-06
7440-48-4	COBALT	7.69	1,900	5.E-08	13,000	0.0030	
7440-50-8	COPPER	8.95			41,000	0.00024	
7439-89-6	IRON	13,000			100,000	0.047	
7439-92-1	LEAD	12.5			800	NE	
7439-96-5	MANGANESE	219			19,000	0.031	
7439-98-7	MOLYBDENUM	1			5,100	0.00022	
7440-02-0	NICKEL	8.9		5.E-09	20,000	0.00049	6.E-09
7440-24-6	STRONTIUM	100			100,000	0.00018	
7440-62-2	VANADIUM	28			1,000	0.0044	
7440-66-6	ZINC	33.6			100,000	0.00012	
Total	NA	NA	NA	3.E-06	NA	0.14	2.E-05

Notes:

- ^a EPC is the 95 percent UCL of the mean for normal, lognormal, and nonparametric
- ^b metals with an associated cancer risk greater than 1×10^{-6} or an HI greater than 0.1 are shaded
- ^c complete risk calculations presented in Appendix H (Part XVIII)

Acronyms/Abbreviations:

- bgs – below ground surface
- CAS – Chemical Abstracts Service
- EPC – exposure point concentration
- HI – hazard index
- mg/kg – milligrams per kilogram
- NA – not applicable
- NE – not evaluated; risk from lead is evaluated using LeadSpread 7 model
- PRG – preliminary remediation goal
- UCL – upper confidence limit

Section 7

CONCLUSIONS AND RECOMMENDATIONS

CAOC-specific conclusions and recommendations are presented in Attachments A through G of this report. This section presents a summary of the RI recommendations for each CAOC.

CERCLA (1980) requirements, the NCP, and applicable or relevant and appropriate requirements were used to formulate the CAOC-specific recommendations presented here. The data collected during the RI and previous investigations were sufficient to characterize the nature and extent of contamination, to perform baseline HHRAs, and to support decisions on the necessity for future work at the OU 7 CAOCs. The following are recommended for each of the CAOCs.

CAOC 9.60, Former UST T-530B

- no further action for soil
- groundwater monitoring of well 9.60-MW-1 for VOCs (including chloroform) under the OU 1 Groundwater Monitoring Program (additional wells may be installed/monitored to further assess the groundwater gradient)

CAOC 10.27, Old Fire-Fighting Training Facility

- no further action

CAOC 10.35, Old Domestic Wastewater Treatment Plant

- no further action for soil
- groundwater monitoring of existing or future monitoring wells (in the vicinity of CAOC 10.35) for 4,4'-DDT under the OU 2 Groundwater Monitoring Program

CAOC 10.37, Industrial Wastewater Treatment Plant

- further investigation to define the extent of PAHs and chloroform in soil in the following areas:
 - north and northwest of Evaporation Basin 4
 - southeast to southwest of boring N10.37-1
 - south and east of Evaporation Basin 5
- groundwater monitoring of wells NSI-3, T-325-MW3, and NE-23 for VOCs (including chloroform) under the OU 2 Groundwater Monitoring Program

CAOC 10.38/10.39, Domestic and Industrial Wastewater Collection Lines

- no further action for Units 1 through 6, and for soil at Unit 7
- further investigation of groundwater at Unit 7

CAOC N-2 Area 1, Former Storage Area (Because of a change in the investigative approach to the CAOC, the following recommendations incorporate the former skeet and trap range area, which is the primary source of PAHs in soil.)

Section 7 Conclusions and Recommendations

- further assessment of PAHs west of borings N2-RI-1 and N2-RI-2, and north and west of boring N2-RI-3
- further assessment for the portion of the CAOC east of the CAOC 7 landfill cap to assess the potential presence of SVOCs, PCBs, and metals
- investigation and delineation of the lead shot associated with the former skeet and trap range
- name change for the CAOC to the Former Storage Area and Skeet and Trap Range

CAOC 10, Sodium Valve Burial Area

- advance three borings around RI sample location 10-Trench-B1 and collect soil samples for lead analysis to support a no further action recommendation

Section 8

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